Giga-tronics

Operating and Maintenance Manual

Model 58542

VXI Universal
Power Meter

Model 58542
VXI Universal Power Meter



Operating and Maintenance Manual

INSTRUMENT SERIAL NUMBER _____

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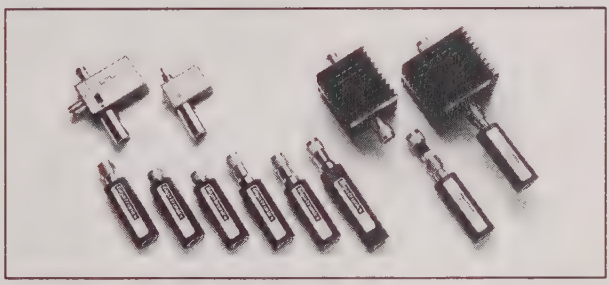
CHAPTER 1

GENERAL INFORMATION

INTRODUCTION

The Giga-tronics Model 58542 VXI Universal Power Meter is a high accuracy, ultra-fast reading rate, dual input power meter. Depending on the sensor used, frequency coverage is from 10 MHz to 40 GHz for CW signals and 50 MHz to 40 GHz for pulsed signals.

The 58542 is optimized for fast measurements over the VXI bus. Maximum measurement speed is achieved by using an internal data buffer which logs a user specifiable number of measurements for subsequent transfer over the VXI bus.



Precision Return Loss Bridges and CW Power Sensors

The 58542 uses Giga-tronics 80300 Series diode-based sensors for fast measurements with a wide dynamic range of up to 90 dB, depending on the sensor. Excellent linearity of ±0.5% is assured through the use of a built-in power sweep calibrator.

Special purpose CW sensors are available including special low VSWR sensors and 4 high power versions (1W, 5W, 25W, and 50W) plus True RMS sensors with 50 dB dynamic range.

Peak Power Sensors are available for making true instantaneous power readings on pulsed signals such as radar and digital communications signals. The pulse sensors sample pulsed RF signal amplitude directly; therefore no duty cycle correction is required.



Peak Power Sensors

The 58542 Power Meter is optimized for the fast measurements required by ATE systems. The 58542's diode based sensors have response times orders of magnitude faster than thermal sensors. In addition, the high measurement speeds are available over a much wider dynamic range than with thermal sensors.

The Giga-tronics 58542 uses a standardized instrument command language called SCPI - the Standard Commands for Programmable Instruments. The 58542 is a message based instrument that responds to high level, ASCII character SCPI commands. The industry-standard English-like commands are parsed and interpreted by the power meter. SCPI commands make program development fast and easy due to their standardized, common language format.

The Giga-tronics power sweep calibrator incorporates a built-in thermistor based power meter bridge. The thermistor's ovenized stability is used to provide a standard 1 mW power reference at 50 MHz traceable to NIST. The thermistor's inherent linearity is used to produce 51 precisely controlled power levels from -30 to +20 dBm for linearizing the diodes used in the power sensors.

The excellent resulting linearity of ±0.5% (±0.02 dB) complements the low VSWR of the sensors and tightly specified Cal Factor uncertainty. The Cal Factors are stored in EEPROMs in each sensor so that a user only has to enter frequency of operation to the power meter to obtain frequency corrected power readings.

SYSTEM SPECIFICATIONS

Specifications describe the instrument's warranted performance, and apply when using 80300A Series Power Sensors. Typical performance, (shown in italics), is non-warranted.

POWER METER

Frequency Range: 10 MHz to 40 GHz [1]
Power Range: -70 dBm to +47 dBm (100 pW to 50 Watt) [1]
Single Sensor Dynamic Range:
CW Sensors: 90 dB [1]
Peak Power Sensors: 40 dB, Peak
50 dB, CW [1]

ACCURACY:
Calibrator: Power Sweep calibration signal to dynamically linearize the sensors.
Frequency: 50 MHz nominal.
Settability: The 1 mW (0.0 dBm) level in the Power Sweep Calibrator is factory set to ±0.7% traceable to the National Institute of Standards and Technology (NIST). Measure within 15 seconds of setting calibrator to 0.0 dBm.
Accuracy: ±1.2% worst case for one year, over temperature range of 5° to 35°C.
Connector: Type N(f) connector, 50 ohm.
VSWR: <1.05 (Return Loss >33 dB).

System Linearity at 50 MHz for Standard CW Sensors:
±0.02 dB over any 20 dB range from -70 to +16 dBm
±0.02 dB + (+0 dB, -0.05 dB/dB) from +16 to +20 dBm
±0.04 dB from -70 to +16 dBm
Temperature Coefficient of Linearity:
<0.1%/°C temperature change following Power Sweep Calibration.
24 hour warm-up required.
Zeroing Accuracy: (Standard CW Sensors)
Zero Set: <*±50 pW* [2]
Zero Drift: <*±100 pW* during 1 hour. [2]
Noise: <*±50 pW* measured over any 1 minute interval. [2]
Averaging: Auto-averaging or user selectable averaging from 1 to 512 readings per measurement.

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[1] Depending on sensor used.
[2] Specified performance applies with maximum averaging and 24 hour warm-up at constant temperature.

SPECIFICATIONS

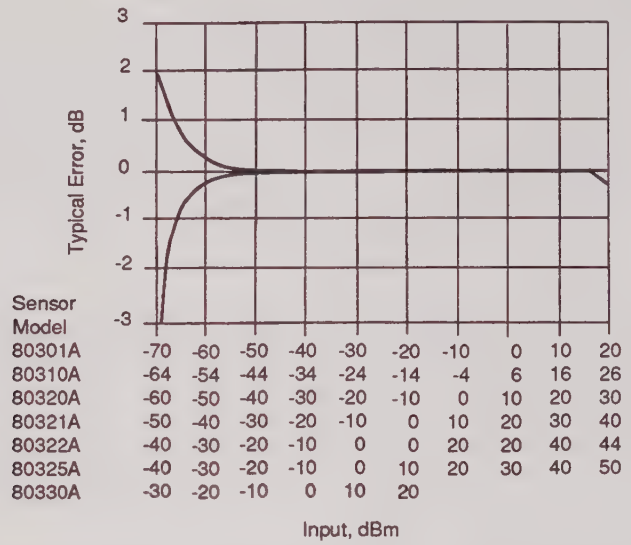


Figure 1-1. Instrument Linearity plus Typical Noise and Zeroing Error vs Input Power. (The X-axis scale is sensor dependent)

Meter Functions

dB Offset and Relative:
Allows both relative readings and offset readings. Power readings can be offset by -99.999 to +99.999 dB to account for external loss/ gain.

Configuration Storage Registers:
Allows up to 10 instrument configurations to be stored and recalled from non-volatile memory for fast configuration changes.

Power Measurements: Any two of the following channel configurations, simultaneously: 1, 2, 1/2, 2/1, 1-2, 2-1

Measurement Speed

Measurement Rates

Measurement speed increases significantly using the 58542's data storage capabilities. Storing data in the power meter's memory for later down loading to your controller reduces word serial protocol and protocol conversion overhead. Up to 128,000 readings can be buffered. The table below illustrates typical maximum measurement rates for CW power sensors or 80340 Series Peak Power Sensors. Measurement rate depends on several factors including controller speed and number of averages. Burst Mode speed does not include bus communication time.

Normal Mode Non-Buffered	**Swift Mode** Buffered Data	**Burst Mode** Buffered Data
55 rdgs/s	150 rdgs/s	5100 rdgs/s

Individual data points are read immediately after measurement in the Normal Mode. Swift Mode allows triggering of individual data points, and stores the data in the 58542's memory. Burst Mode also buffers measurement data: measurement timing of individual data points is controlled by setting the time interval (0.001 to 5.000 sec) between the data points following a single group "burst" trigger event.

Inputs / Outputs

Analog Output (ANALOG OUT BNC connector):
Provides an output voltage configurable from -10 to +10V from either Channel 1 or Channel 2 in either Lin or Log units, *
Accuracy: *1.0 % ± 32 mV*, -10V to 10V
Linearity: *< 0.3 %*

Trigger Input (EXT TRIG BNC connector):
Used to connect EXT trigger. TTL level input signal for fast reading buffered data modes.

Voltage proportional to Frequency, GHz (VpropF IN BNC):
Allows automated Cal Factor correction. Input the analog VpropF signal level from the microwave signal source. *
Input Range: 0.0V to 10V
Accuracy: *1.0 % ± 32 mV* (14 bit) (0.6 mV resolution)

General Specifications

Temperature Range:
Operating: 0° to 50°C (+32° to +122°F)
Storage: -40°C to 70°C (-40° to +158°F)
Power Requirements: +5VDC @ 800 mA
+24VDC @ 250 mA
-24VDC @ 250 mA

Physical Characteristics:
Dimensions: C-size, single slot VXI standard
30 mm (1.2 in) wide, 234 mm (9.2 in) high,
340 mm (13.4 in) deep.
Weight: 2.5 kg (5.5 lbs)

Accessories Included

One Operation and Maintenance Manual and two detachable sensor cables are included.

Options

Option 02: Add 256kB buffer for fast measurements. Stores 128k single channel readings or 64k each dual channel readings.

* Operates in Normal Mode only.

POWER SENSORS

The Standard CW Sensors measure CW signals from -70 to +20 dBm. The 58542 Universal Power Meter also uses Peak Power Sensors for measuring radar and digital modulation signals.

Gigatronics' True RMS sensors are recommended for applications such as measuring quadrature modulated signals, multi-tone receiver intermodulation distortion power, noise power, or the compression power of an amplifier. These sensors include a pad to attenuate the signal to the RMS region of the diode's response. This corresponds to the -70 dBm to -20 dBm "linear" operating region of Standard CW Sensors. The pad improves the input VSWR to ≤1.15 at 18 GHz.

High Power (1, 5, 25, and 50 Watt) and Low VSWR sensors are also available for use with the 58542 Power Meter.

POWER SENSOR CAL FACTOR UNCERTAINTIES (See page 1-9 for 80350A Series)

Freq. (GHz)		Sum of Uncertainties (%)[6]						Probable Uncertainties (%)[7]					
Lower	Upper	80301A 80302A 80340	80303A 80304A 80343 80344	80310A 80313A 80314A	80320A 80323A 80324A	80321A[8] 80322A[8] 80325A[8]	80330A 80333A 80334A	80301A 80302A 80340	80303A 80304A 80343 80344	80310A 80313A 80314A	80320A 80323A 80324A	80321A[8] 80322A[8] 80325A[8]	80330A 80333A 80334A
0.1	1	1.61	3.06	2.98	2.96	7.61	2.95	1.04	1.64	1.58	1.58	4.54	1.58
1	2	1,95	3.51	3.58	3.57	7.95	3.55	1.20	1.73	1.73	1.73	4.67	1.73
2	4	2.44	4.42	4.33	4.29	8.44	4.27	1.33	1.93	1.91	1.91	4.89	1.90
4	6	2.67	4.74	4.67	4.63	8.67	4.60	1.41	2.03	2.02	2.01	5.01	2.01
6	8	2.86	4.94	4.87	4.82	8.86	4.80	1.52	2.08	2.07	2.06	5.12	2.06
8	12.4	3.59	6.04	5.95	5.90	9.59	5.87	1.92	2.55	2.54	2.53	5.56	2.53
12.4	18	4.09	6.86	6.76	6.69	10.09	6.64	2.11	2.83	2.80	2.79	5.89	2.78
18	26.5	---	9.27	9.43	9.28	----	9.21	---	3.63	3.68	3.62	----	3.59
26.5	40	---	15.19	14.20	13.86	----	13.66	---	6.05	5.54	5.39	----	5.30

(See the bottom of page 1-7 in this manual, and the 80340 Series Triggerable Pulse (*Peak Power*) Sensor Data Sheet or the 80340 Series Triggerable Pulse (*Peak Power*) Sensor Operating and Maintenance Manual for additional 80340 Series sensor specifications.)

[6, 7, 8] = see page 1-9

POWER SENSOR SELECTION GUIDE (See page 1-8 for 80350A Series)

Model	Frequency Range / Power Range	Maximum Power	Power Linearity [4] (Freq >8 GHz)	VSWR	RF Connector	Dimensions Length	Dimensions Diameter	Weight
STANDARD CW SENSORS								
80301A	10 MHz to 18 GHz -70 to +20 dBm	+23 dBm (200 mW)	-70 to -20 dBm: ±0.00 dB -20 to +20 dBm: ±0.05 dB/10 dB	10 MHz - 2 GHz: 1.12 2 GHz - 12.4 GHz: 1.22 12.4 GHz - 18 GHz: 1.29	Type N(m) 50Ω	114.5 mm (4.5 in)	32 mm (1.25 in)	0.18 kg (0.4 lb)
80302A	10 MHz to 18 GHz -70 to +20 dBm	+23 dBm (200 mW)	-70 to +20 dBm: ±0.00 dB -20 to +20 dBm: ±0.05 dB/10 dB	10 MHz - 2 GHz: 1.12 2 GHz - 12.4 GHz: 1.22 12.4 GHz - 18 GHz: 1.29	APC-7 50Ω	114.5 mm (4.5 in)	32 mm (1.25 in)	0.18 kg (0.4 lb)
80303A	10 MHz to 26.5 GHz -70 to +20 dBm	+23 dBm (200 mW)	-70 to +20 dBm: ±0.00 dB -20 to +20 dBm: ±0.1 dB/10 dB	10 MHz - 2 GHz: 1.12 2 GHz - 12.4 GHz: 1.22 12.4 GHz - 18 GHz: 1.38 18 GHz - 26.5 GHz: 1.43	Type K(m) [1] 50Ω	114.5 mm (4.5 in)	32 mm (1.25 in)	0.18 kg (0.4 lb)
80304A	10 MHz to 40 GHz -70 to 0 dBm	+23 dBm (200 mW)	-70 to -20 dBm: ±0.00 dB -20 to 0 dBm: ±0.2 dB/10 dB	10 MHz - 2 GHz: 1.12 2 GHz - 12.4 GHz: 1.22 12.4 GHz - 18 GHz: 1.38 18 GHz - 26.5 GHz: 1.43 26.5 GHz - 40 GHz: 1.92	Type K(m) [1] 50Ω	114.5 mm (4.5 in)	32 mm (1.25 in)	0.23 kg (0.5 lb)
LOW VSWR CW SENSORS								
80310A 80313A 80314A	10 MHz to 18 GHz -64 to +26 dBm 10 MHz to 26.5 GHz -64 to +26 dBm 10 MHz to 40 GHz -64 to +6 dBm	+29 dBm (800 mW)	-64 to -14 dBm: ±0.00 dB -14 to +26 dBm: ±0.05 dB/10 dB -64 to -14 dBm: ±0.00 dB -14 to +26 dBm: ±0.1 dB/10 dB -64 to -14 dBm: ±0.00 dB -14 to +6 dBm: ±0.2 dB/10 dB	10 MHz - 2 GHz: 1.13 2 GHz - 12 GHz: 1.16 12 GHz - 18 GHz: 1.23 18 GHz - 265. GHz: 1.29 265. GHz - 40 GHz: 1.50	Type K(m) [1] 50Ω	127 mm (5.0 in)	32 mm (1.25 in)	0.23 kg (0.5 lb)
1W CW SENSORS								
80320A 80323A 80324A	10 MHz to 18 GHz -60 to +30 dBm 10 MHz to 26.5 GHz -60 to +30 dBm 10 MHz to 40 GHz -60 to +10 dBm	+30 dBm (1 W)	-60 to -10 dBm: ±0.00 dB -10 to +30 dBm: ±0.05 dB/10 dB -60 to -10 dBm: ±0.00 dB -10 to +30 dBm: ±0.1 dB/10 dB -60 to -10 dBm: ±0.00 dB -10 to +10 dBm: ±0.2 dB/10 dB	10 MHz - 2 GHz: 1.11 2 GHz - 12 GHz: 1.12 12 GHz - 18 GHz: 1.18 18 GHz - 26.5 GHz: 1.22 26.5 GHz - 40 GHz: 1.36	Type K(m) [1] 50Ω	127 mm (5.0 in)	32 mm (1.25 in)	0.23 kg (0.5 lb)
5W CW SENSOR [2]								
80321A	10 MHz to 18 GHz -50 to +37 dBm	+37 dBm (5 W)	-50 to 0 dBm: ±0.00 dB 0 to +37 dBm: ±0.05 dB/10 dB	10 MHz - 6 GHz: 1.20 8 GHz - 12.4 GHz: 1.25 12.4 - 18 GHz: 1.35	Type N(m) 50Ω	150 mm (5.9 in)	32 mm (1.25 in)	0.23 kg (0.5 lb)
25W CW SENSOR [3]								
80322A	10 MHz to 18 GHz -40 to +44 dBm	+44 dBm (25 W)	-40 to +10 dBm: ±0.00 dB +10 to +44 dBm: ±0.05 dB/10 dB	10 MHz - 6 GHz: 1.20 6 GHz - 12.4 GHz: 1.30 12.4 GHz - 18 GHz: 1.40	Type N(m) 50Ω	230 mm (9.0 in)	104 mm (4.1 in)	0.3 kg (0.6 lb)
50W CW SENSOR [3]								
80325A	10 MHz to 18 GHz -40 to +47 dBm	+47 dBm (50 W)	-40 to +10 dBm: ±0.00 dB +10 to +47 dBm: ±0.05 dB/10 dB	10 MHz - 6 GHz: 1.25 6 GHz - 12.4 GHz: 1.35 12.4 GHz - 18 GHz: 1.45	Type N(m) 50Ω	230 mm (9.0 in)	104 mm (4.1 in)	0.3 kg (0.6 lb)
TRUE RMS SENSORS (-30 to +20 dBm)								
80330A 80333A 80334A	10 MHz to 18 GHz 10 MHz to 26.5 GHz 10 MHz to 40 GHz	+33 dBm (2 W)	-30 to +20 dBm: ±0.00 dB	10 MHz - 12 GHz: 1.12 12 GHz - 18 GHz: 1.15 18 GHz - 26.5 GHz: 1.18 26.5 GHz - 40 GHz: 1.29	Type K(m) [1] 50Ω	152.5 mm (6.0 in)	32 mm (1.25 in)	0.27 kg (0.6 lb)
80340 SERIES PEAK POWER SENSORS (-30 TO +20 dBm)								
80340 80343 80344	50 MHz to 18 GHz 50 MHz to 26.5 GHz 50 MHz to 40 GHz	+23 dBm (200mW)	-30 to 0 dBm: ±0.13 dB 0 to +20 dBm: ±0.13 dB ±0.01 dB/dB	50 MHz - 2 GHz: 1.12 2 GHz - 12.4 GHz: 1.22 12.4 GHz - 18 GHz: 1.37 18 GHz - 26.5 GHz: 1.50 26.5 GHz - 40 GHz: 1.92	Type N(m) 50Ω Type K(m) [1] 50Ω	146 mm (5.75 in)	37 mm (1.44 in)	0.3 kg (0.6 lb)

[1, 2, 3, 4] See page 1-9

80350A SERIES PEAK POWER SENSOR SELECTION GUIDE

Model	Frequency Range / Power Range	Maximum Power	Power Linearity[4]	VSWR	RF Connector	Dimensions		Weight
						Length	Diameter	
STANDARD PEAK POWER SENSORS								
80350A	45 MHz to 18 GHz -20 to +20 dBm, Peak -30 to +20 dBm, CW	+23 dBm (200 mW) CW or Peak	-30 to -20 dBm: ±0.00 dB -20 to +20 dBm: ±0.05 dB/10dB	45 MHz - 2 GHz: 1.12 2 GHz - 12.4 GHz: 1.22 12.4 GHz - 18 GHz: 1.37	Type N(m) 50Ω	165 mm (6.5 in)	37 mm (1.25 in)	0.3 kg (0.7 lb)
80353A	45 MHz to 26.5 GHz -20 to +20 dBm, Peak -30 to +20 dBm, CW	+23 dBm (200 mW) CW or Peak	-30 to -20 dBm: ±0.00 dB -20 to +20 dBm: ±0.1 dB/10dB	45 MHz - 2 GHz: 1.12 2 GHz - 12.4 GHz: 1.22 12.4 GHz - 18 GHz: 1.37 18 GHz - 26.5 GHz: 1.50	Type K(m)[1] 50Ω	165 mm (6.5 in)	37 mm (1.25 in)	0.3 kg (0.7 lb)
80354A	45 MHz to 40 GHz -20 to +0.0 dBm, Peak -30 to +0.0 dBm, CW	+23 dBm (200 mW) CW or Peak	-30 to -20 dBm: ±0.00 dB -20 to 0.0 dBm: ±0.2 dB/10dB	45 MHz - 2 GHz: 1.12 2 GHz - 12.4 GHz: 1.22 12.4 GHz - 18 GHz: 1.37 18 GHz - 26.5 GHz: 1.50 26.5 GHz - 40 GHz: 1.92	Type K(m)[1] 50Ω	165 mm (6.5 in)	37 mm (1.25 in)	0.3 kg (0.7 lb)
5W PEAK POWER SENSOR [2,5]								
80351A	45 MHz to 18 GHz 0.0 to +40 dBm, Peak -10 to +37 dBm, CW	CW: +37 dBm (5 W Avg.) Peak: +43 dBm	-10 to +0 dBm: ±0.00 dB +0 to +40 dBm: ±0.05 dB/10dB	45 MHz - 4 GHz: 1.15 4 GHz - 12.4 GHz: 1.25 12.4 GHz - 18 GHz: 1.35	Type N(m) 50Ω	200 mm (7.9 in)	37 mm (1.25 in)	0.3 kg (0.7 lb)
25W PEAK POWER SENSOR [3,5]								
80352A	45 MHz to 18 GHz +10 to +50 dBm, Peak 0.0 to +44 dBm, CW	CW: +44 dBm (25 W Avg.) Peak: +53 dBm	0.0 to +10 dBm: ±0.00 dB +10 to +50 dBm: ±0.05 dB/10dB	45 MHz - 6 GHz: 1.20 6 GHz - 12.4 GHz: 1.30 12.4 GHz - 18 GHz: 1.40	Type N(m) 50Ω	280 mm (11.0 in)	104 mm (4.1 in)	0.3 kg (0.7 lb)
50W PEAK POWER SENSOR [3,5]								
80355A	45 MHz to 18 GHz +10 to +50 dBm, Peak 0.0 to +47 dBm, CW	CW: +47 dBm (50 W Avg.) Peak: +53 dBm	0.0 to +10 dBm: ±0.00 dB +10 to +50 dBm: ±0.05 dB/10dB	45 MHz - 6 GHz: 1.25 6 GHz - 12.4 GHz: 1.31 12.4 GHz - 18 GHz: 1.45	Type N(m) 50Ω	280 mm (11.0 in)	104 mm (4.1 in)	0.3 kg (0.7 lb)

(See the 80350A Series Peak Power Sensor Data Sheet or the 80350A Series Peak Power Sensor Operating and Maintenance Manual for additional specifications.)

80350A SERIES PEAK POWER SENSOR CAL FACTOR UNCERTAINTIES

Freq. (GHz)		Sum of Uncertainties (%)[6]					Probable Uncertainties (%)[7]		
Lower	Upper	80350A	80353A 80354A	80351A[8]	80352A[8]	80355A[8]	80350A	80353A 80354A	80351A[8] 80352A[8] 80355A[8]
0.1	1	1.61	3.06	9.09	9.51	10.16	1.04	1.64	4.92
1	2	1.95	3.51	9.43	9.85	10.50	1.20	1.73	5.04
2	4	2.44	4.42	13.10	13.57	14.52	1.33	1.93	7.09
4	6	2.67	4.74	13.33	13.80	14.75	1.41	2.03	7.17
6	8	2.86	4.94	13.52	13.99	14.94	1.52	2.08	7.25
8	12.4	3.59	6.04	14.25	14.72	15.67	1.92	2.55	7.56
12.4	18	4.09	6.86	19.52	20.97	21.94	2.11	2.83	12.37
18	26.5	---	9.27	----	----	----	---	3.63	----
26.5	40	---	15.19	----	----	----	---	6.05	----

[1] The K connector is electrically and mechanically compatible with the APC-3.5 and SMA connectors.
[2] Power coefficient equals <0.01 dB/Watt(AVG.)
[3] Power coefficient equals <0.015 dB/Watt(AVG.)
[4] For frequencies above 8 GHz, add power linearity to system linearity.
[5] Peak operating range above CW maximum range is limited to <10% duty cycle.
[6] Includes uncertainty of reference standard and transfer uncertainty. Directly traceable to NIST.
[7] Square root of sum of the individual uncertainties squared (RSS).
[8] Cal Factor numbers allow for 3% repeatability when re-connecting attenuator to sensor, and 3% for attenuator measurement uncertainty and mismatch of sensor/pad combination. Attenuator frequency response is added to the Sensor Cal Factors which are stored in the sensor's EEPROM.

DIRECTIONAL BRIDGES

DIRECTIONAL BRIDGE SELECTION GUIDE

Model	Frequency Range / Power Range	Maximum Power	Power Linearity	Test Port Match (SWR)	Directivity (dB)	Input Connector	Test Port Connector
80501	10 MHz to 18 GHz -35 to +20 dBm	+27 dBm (0.5W)	-35 to +10 dBm: ±0.1 dB +10 to +20 dBm: ±0.1 dB ±0.005 dB/dB	10 MHz - 8 GHz: <1.17 8 GHz - 18 GHz: <1.27	38	N(f)	N(f)
80502	10 MHz to 18 GHz -35 to +20 dBm	+27 dBm (0.5W)	-35 to +10 dBm: ±0.1 dB +10 to +20 dBm: ±0.1 dB ±0.005 dB/dB	10 MHz - 8 GHz: <1.13 8 GHz - 18 GHz: <1.22	40	N(f)	APC-7
80503	10 MHz to 26.5 GHz -35 to +20 dBm	+27 dBm (0.5W)	-35 to +10 dBm: ±0.1 dB +10 to +20 dBm: ±0.1 dB ±0.005 dB/dB	10 MHz - 8 GHz: <1.22 8 GHz - 18 GHz: <1.22 18 GHz - 26.5 GHz: <1.27	35	SMA(f)	SMA(f)
80504	10 MHz to 40 GHz -35 to +20 dBm	+27 dBm (0.5W)	-35 to +10 dBm: ±0.1 dB +10 to +20 dBm: ±0.1 dB ±0.005 dB/dB	10 MHz - 8 GHz: <1.35 8 GHz - 18 GHz: <1.35 18 GHz - 26.5 GHz: <1.35 26.5 GH - 40 GHz: <1.44	30	K(f)[1]	K(f)[1]

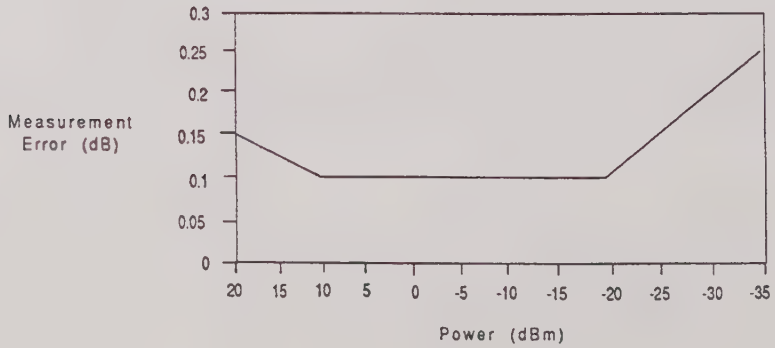
The 80500 Series CW Directional Bridges are designed specifically for use with Giga-tronics power meters to measure the Return Loss/SWR of a test device. Each bridge includes an EEPROM which has been programmed with Identification Data for that bridge.

The Selection Guide above shows primary specifications. Additional specifications are:

Bridge Frequency Response:

Return loss measurements using the 58542 power meter can be frequency compensated using the standard "Open/ Short" supplied with the bridge.

Directional Bridge Linearity Plus Zero Set and Noise vs Input Power
(50 MHz, 25°C ±5°C)



Insertion Loss: 6.5 dB, nominal, from input port to test port

Maximum Input Power: +27 dBm (0.5W)

Dimensions:

80501:	76 x 50 x 28 mm	(3 x 2 x 1 1/8 in)
80502:	76 x 50 x 28 mm	(3 x 2 x 1 1/8 in)
80503:	19 x 38 x 29 mm	(3/4 x 1 1/2 x 2 1/8 in)
80504:	19 x 38 x 29 mm	(3/4 x 1 1/2 x 2 1/8 in)

Weight:

80501:	340 g	(12 oz)
80502:	340 g	(12 oz)
80503:	198 g	(7 oz)
80504:	198 g	(7 oz)

Directional Bridge Accessories:

An Open/Short is included for establishing the 0 dB return loss reference during path calibration.

CHAPTER 2

INITIAL INSTRUCTIONS

PREPARATION FOR USE

This section will cover the following topics:

- Logical Address Selection
- Data Transfer Arbitration
- Installation
- Sensor Precautions
- Returning the Instrument

Logical Address Selection

The VXI chassis Resource Manager identifies units in the system by the unit's logical address. The VXI logical address can range from 0 to 255. Addresses 0 and 255 are reserved for special functions. Address 0 identifies the Resource Manager (slot and controller). Address 255 permits the Resource Manager to dynamically address the unit based on the unit's VXI chassis slot.

To change the Model 58542's logical address, use the eight position DIP switch (see Figure 2-1 on the next page) accessible after removing the right side housing cover of the unit. The Model 58542 uses binary values (2^0 to 2^7) to set the address. Switch position number one is the least significant bit of the address. Insert A in Figure 2-1 illustrates the switch positions for a logical address of 3.

Giga-tronics ships the Model 58542 with a logical address of 255 for Dynamic Configuration. Refer to Insert B in Figure 2-1.

Data Transfer Bus Arbitration

The Model 58542 has VMEbus Mastership capability. When enabled, the 58542 sends Responses and Events as signals (software interrupts) to its Commander's Signal Register. The Model 58542 cannot drive the interrupt lines.

The Model 58542 is configured as a level 3 requestor by the factory. The level 3 Bus Request and Bus Grant lines are used (BR3*, BG3IN*, and BG3OUT*). The other Bus Grant lines are daisy-chained by jumpers. The VMEbus specifications describe three

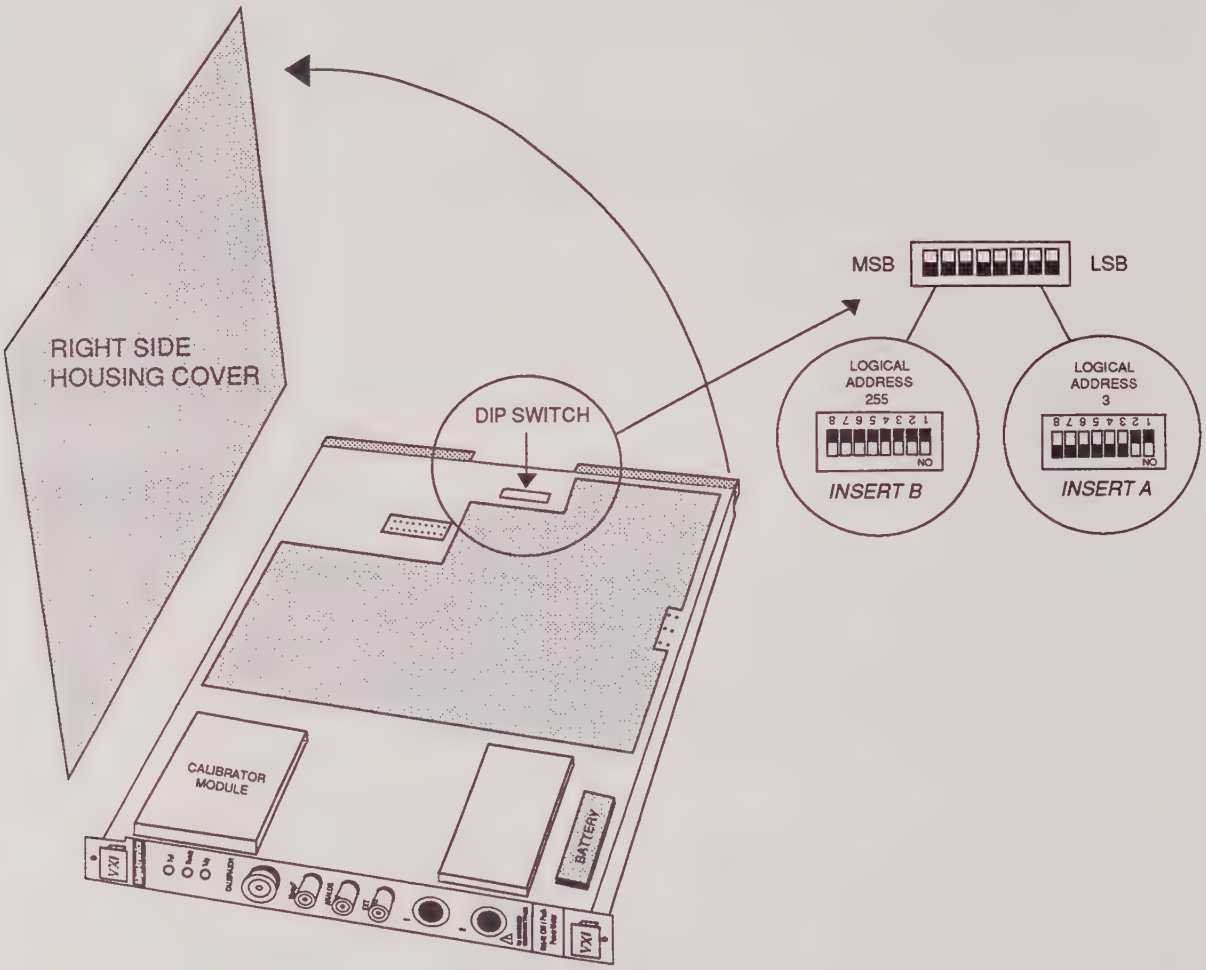


Figure 2-1. Setting the Logical Address

priority schemes: Prioritized, Round-robin, and Single level. The Prioritized arbitration assigns the bus according to a fixed priority scheme where each of four bus lines has a priority from highest (BR3*) to lowest (BR0*). Round-robin arbitration assigns the bus on a rotating basis. Single level arbitration only accepts requests on BR3*.

If a different requestor level is required, the jumpers must be changed. Figure 2-2 on the next page will aid in reconfiguring the Model 58542 to a new level. Refer to the VMEbus specification for more information on *data transfer bus arbitration.*

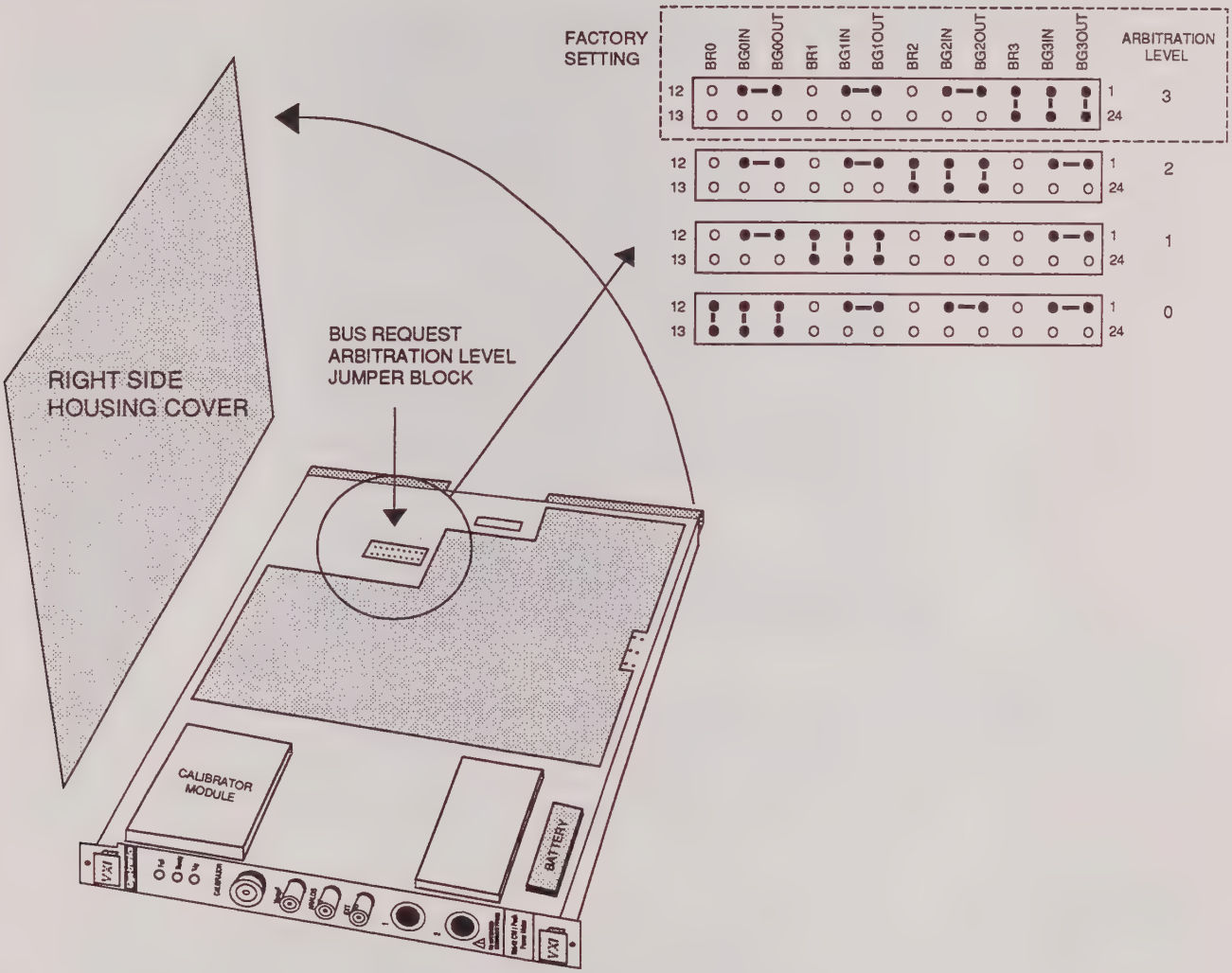


Figure 2-2. Bus Arbitration Level Jumpers

INSTALLATION

The 58542 VXI Power Meter installs easily into a VXI mainframe in any slot except slot 0 (zero). When inserting the instrument into the mainframe, it should be gently rocked back and forth to seat the connectors into the backplane receptacles. The ejectors will be at right angles to the front panel when the instrument is properly seated into the backplane. The two captive screws above and below the ejectors are used to secure the instrument into the chassis.

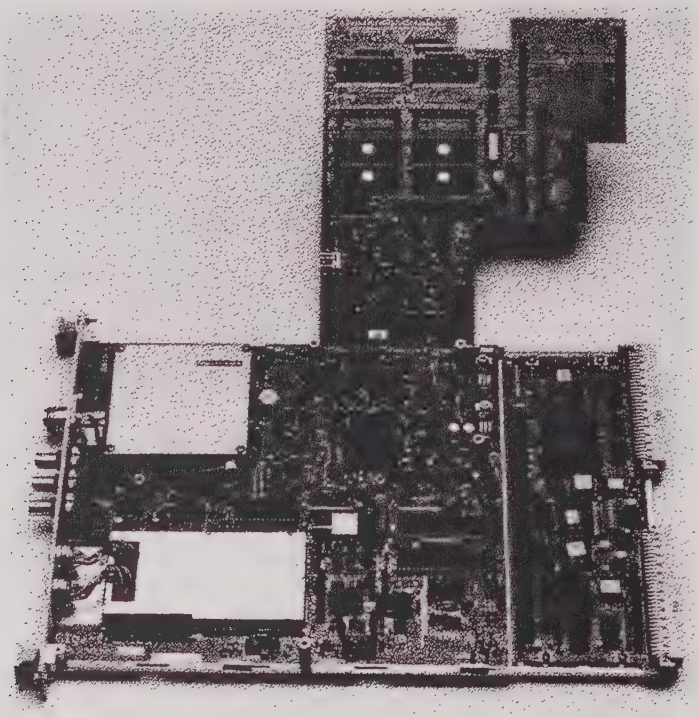


Figure 2-3. Model 58542 VXIbus Universal Power Meter With Digital PC Board Removed. The Analog PC Board (bottom) and the Digital PC Board (top) are attached to one side of the chassis. (The VXI Processor Board is located to the right of the Analog PC Board in the above photo.)

GENERAL DESCRIPTION

The 58542 VXIbus Universal Power Meter contains three printed circuit boards: the Analog PC Board, the VXI Processor Board, and the Digital PC Board. The Analog PC Board contains the front panel connectors, the Power Sweep Calibrator (beneath the top metal cover), and the dual measurement channels (beneath the lower metal cover). The memory backup battery, which should always be replaced every three years, is attached to this lower metal cover. The VXI Processor Board contains the 68000 processor, connection to the VXIbus backplane (P1 upper connector, P2 lower connector in Figure 2-3), and two EEPROMS containing communications software. The software must be compatible with the EEPROMs on the Digital PC Board. The Digital PC Board contains connections for access to the VXI backplane TTL triggering, and the main operational software. These EEPROMs will be replaced whenever operation software upgrades are performed.

SENSOR PRECAUTIONS

Sensors used with the 58542 VXI Power Meter are configured in a metal housing to provide superior mechanical performance as well as excellent shielding. When connecting the sensors to other devices or components it must be remembered that **THE BODY OF THE SENSOR SHOULD NEVER BE TURNED IN ORDER TO TIGHTEN THE RF CONNECTION**. Mechanical damage to the connector can result if improper handling is attempted when connecting the sensors. Scratched or damaged connector mating surfaces can lead to inaccurate measurements.

WARNING: All Giga-tronics power sensors contain balanced, zero biased Schottky diodes for power sensing. If the sensor is connected to CW or Peak power devices with power output in excess of +23 dBm (200 mW). degradation or total destruction of the diode will occur. Diodes degraded or destroyed in this manner will not be replaced under warranty. Destructive signal levels are higher for High Power, True RMS, and Low VSWR sensors.

RETURNING THE INSTRUMENT

If the instrument must be returned to Giga-tronics for any reason, the Giga-tronics Customer Service Department must be contacted before the unit is sent so that a Return Authorization (RA) number can be assigned. The telephone number is (408) 734-5780, extension 267, or Fax (408) 747-1265.

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CHAPTER 3

OPERATION

Interface Command Reference: Using Standard Commands for Programmable Instruments

SCPI Standard

The 58542 VXI Power Meter is compatible with the Standard-Commands-for-Programmable-Instruments (SCPI) standard. SCPI promotes consistency in its definition of a common instrument control and measurement command language. The structured approach of the SCPI standard offers test system design engineers a number of system integration advantages that achieve considerable efficiency gains during control program development.

SCPI compatible instrument commands are structured from a common functional organization or "model" of a test instrument. Most of the 58542 VXI Power Meter's configuration and measurement functions fall within the Measurement Function Block and the Trigger Subsystem of the SCPI instrument model.

The 58542 uses the SENSe Subsystem of the Measurement Function Block to implement commands that apply specifically to the individual power sensors; sensor 1, and sensor 2. For example, the SENSe2:CORRection:OFFSet command is used to correct for the attenuation of a signal that passes through an attenuator or coupler before it is measured by power sensor 2.

NOTE: Throughout this manual, some commands will be shown in both upper and lower case type (such as CALCulate and MEMory at the left). The upper case is the *required* input. The whole word can be used if desired.

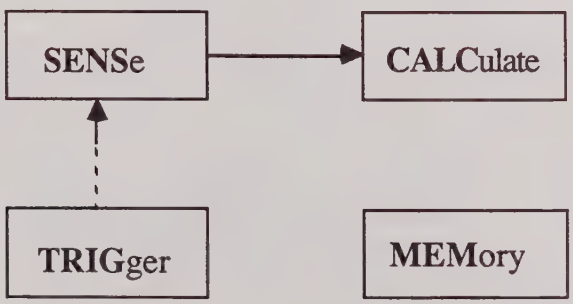


Figure 3-1. SCPI Subsystem Model of the 58542 VXI Power Meter

Sensor and Channel Configuration Using SENSe and CALCulate

The CALCulate Subsystem of the Measurement Function Block contains commands that define the form of the measured data from sensor 1 and sensor 2. Thus, the CALCulate commands define the configuration of the two Software Calculation Channels (channels). For example, the **CALC1:POW 1** command configures channel 1 to report the power level as measured by sensor 1. **CALC2: RAT 2,1** configures channel 2 to report the ratio of power levels, sensor 2 over sensor 1.

Measurement Triggering

The 58542 VXI Power Meter uses the TRIGger Subsystem to trigger measurements in two different operational modes - a normal mode which maximizes the instrument's functionality, and swift and burst modes that maximize the power measurement rate.

MEMory Functions

The MEMory commands control the configuration of the automated Voltage-Proportional-to-Frequency (VpropF), sensor Cal Factor correction, and the Analog Output on the front panel. Each of these connectors is used with external devices. The VpropF can be configured to match the VpropF output of your microwave source. The Analog Output is used with a variety of devices including chart recorders, oscilloscopes, voltmeters, and microwave source leveling inputs.

IEEE-488.2 Common Commands

Consistent with SCPI compliance criteria, the 58542 VXI Power Meter implements all the common commands declared mandatory by IEEE 488.2. These commands are listed in Appendix A on page 3-135 of this chapter.

DIAGnostic commands are used for a variety of instrument specific maintenance and calibration functions. Unless you are performing instrument calibration functions, it is unlikely that you will need to use the DIAGnostic command sets. For calibration laboratory metrology professionals, the DIAG commands will allow you to completely automate instrument and sensor calibration functions. The commands program EEPROMs inside the meter and individual sensors. If desired, a password function is incorporated to prevent unauthorized personnel from altering calibration information. Appendix B on page 6-11 of Chapter 6, Maintenance, shows a listing of available Diagnostic Commands.

CALCulate Subsystem Commands

The CALCulate: commands are used to specify and query the configuration of power measurement channels, known in SCPI references as Software Configuration Channels and in this manual as "channels." (For sensor specific configuration and measurement function control, see SENSe on the next page)

The query form of this command, CALC#? with the appropriate modifier (1 or 2) inserted ahead of the ?, will return the instruments current configuration status for that channel. This can be used to verify configuration commands or return current status information following data acquisition or power measurements.

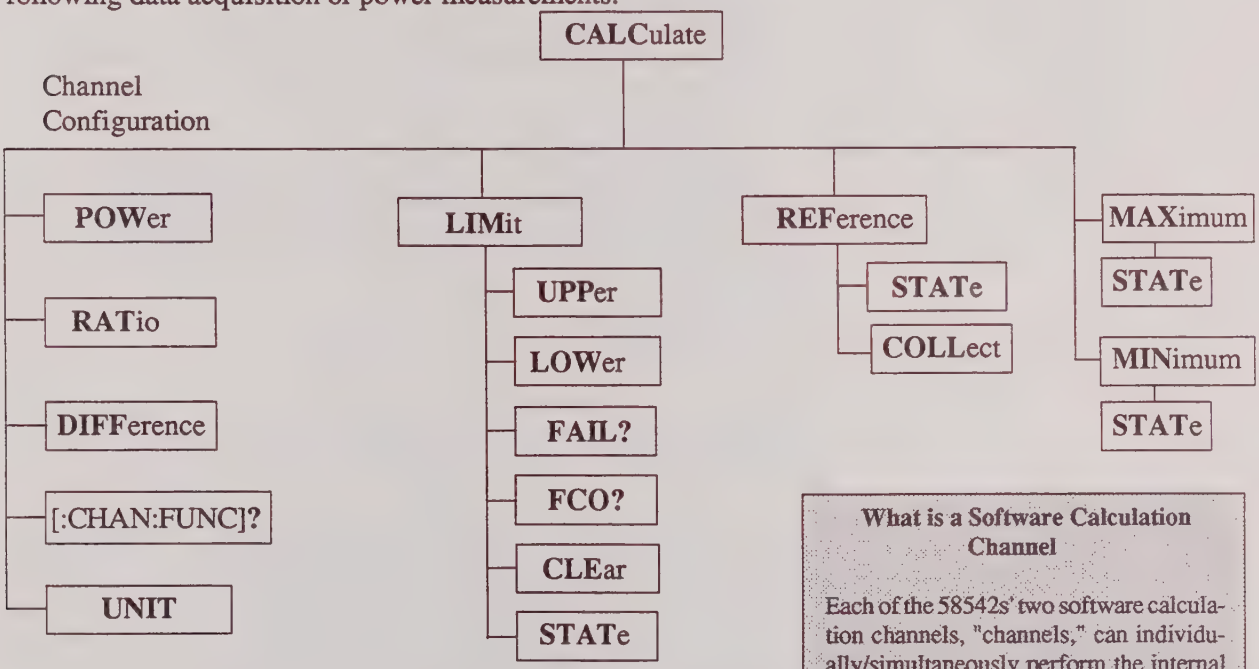


Figure 3-2. CALCulate Subsystem Command Tree

Limit Lines are set on a channel basis. The LIMit commands set limits, monitor the number of violations, and allow the violation counter to be cleared.

The REFerence command allows channel based offset values. For example, using CALC#:REF:COLL automatically converts the inverse of the current channel measurement value to an offset - simplifying the 1 dB compression testing of amplifiers.

MIN and MAX commands monitor deviation of measured values over a user controllable time period.

What is a Software Calculation Channel

Each of the 58542s' two software calculation channels, "channels," can individually/simultaneously perform the internal instrument functions that calculate final measurement data for output over the VXI bus to the controller. The final measurement data is calculated from SENSe Subsystem processed sensor data as well as the CALC subsystem channel configuration data.

This means that only two measurement configurations can be obtained from the 58542 simultaneously. For example, the controller can obtain measurements for sensor 1 and sensor 2/sensor 1 simultaneously, but not sensor 1, sensor 2, and sensor 2/sensor 1 simultaneously.

SENSe Subsystem Commands

The SENSe subsystem sensor configuration commands apply specifically to individual sensors. These commands alter the value of the measured power level according to sensor characteristics. For example, measured power levels can be offset for attenuators or couplers in the measurement path so that the power data reading reflects the power level at the measurement point of interest.

Use SENSe for:

- Averaging power measurements in the 58542 rather than the controller.
- Offsetting power measurements for attenuation or amplification.
- Entering the operating frequency of the measured signal (automatically computes and applies sensor specific Calibration Factor corrections) which compensates for sensor frequency response characteristics.
- Controlling Peak Power Sensor triggering

The SENSe subsystem commands are used to control functions that are related directly to the individual power sensors. That is, these commands control items that would NOT apply to numerical alteration of a ratio measurement of Sensor1/Sensor 2, for example. Controls that would apply to that type of a configuration are channel functions, not sensor functions, and would therefore be located in the CALCulate subsystem, which is described briefly on the previous page. Additional information on SCPI structure and syntax can be obtained from the not-for-profit SCPI Consortium:

Fred Bode, Executive Director
SCPI Consortium
8380 Hercules Drive, Suite P3
La Mesa, CA. 91942

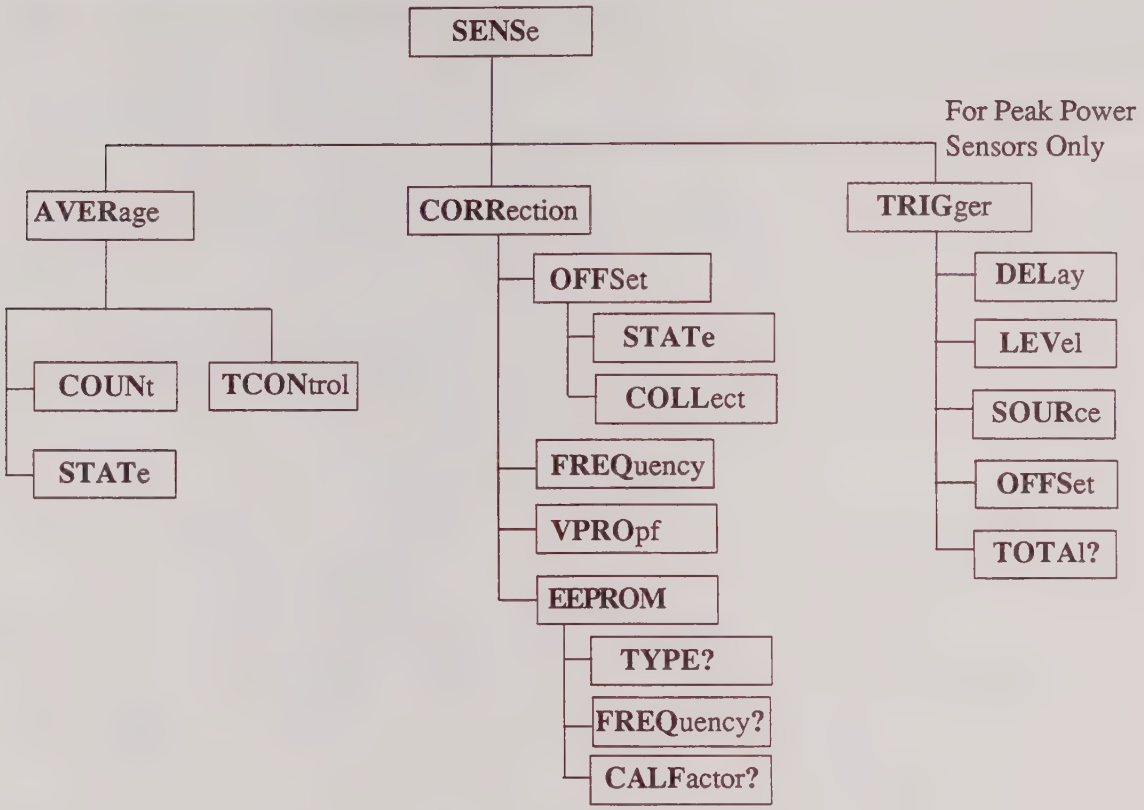


Figure 3-3. SENSe Subsystem Command Tree

The SENSe:AVERage functions control the number of data samples for each measurement and the manner in which those numbers are accumulated. COUNt determines the averaging number or AUTO-averaging. TCONtrol determines whether each new sample is added to previous COUNt # of samples or if COUNt # of samples are taken each time the 58542 instrument is triggered. Please note that the SENSe:TRIGger commands are not instrument triggers, but Peak Power Sensor configuration controls.

The SENSe:TRIGger functions apply only to Giga-tronics Peak Power Sensors. The DELay and LEVel functions of these Peak Power Sensor controls apply to the 80350A Peak Power Sensors, not the 80340 Peak Power (Triggerable Pulse) Sensors. The AVERage and CORRection commands apply to all 80300 Series CW & Peak Power Sensors.

The STATe ON OFF controls for COUNt and DELay, above, are not shown.

TRIGger Subsystem Commands

The TRIGger Subsystem is divided into two sections; Instrument Measurement Event Triggering, and Special Triggering Configuration commands for the fast reading buffered data modes, Burst Mode and Swift Mode.

The query form of these commands, TRIGger? with the appropriate modifier inserted ahead of the ?, will return the instrument's current configuration status. This can be used to verify triggering configuration or return status information following command errors which are commonly caused by using illegal configuration commands during SWIFt or BURSt Modes.

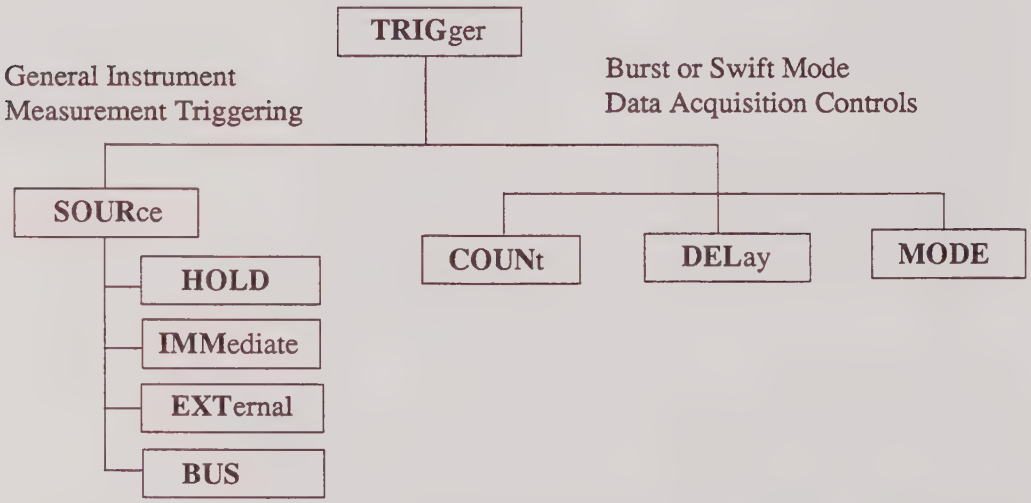


Figure 3-4. TRIGger Subsystem Command Tree

SOURce:IMMediate triggering allows the 58542 to control measurement triggering; this is the default configuration. EXTernal triggering is performed using a TTL signal into the front panel connector. There is provision for connecting this trigger signal to the backplane TTL Triggering, but the ASCII software command syntax remains EXT. BUS allows software controlled triggering.

COUNt refers to the number of data points to store in the 58542's 5000 reading buffer (128,000 with option 02) before the measurement data is requested by the controller. DELay controls the time interval between Burst Mode data samples, and the MODE command controls whether the data is taken after receipt of the instrument trigger or if data is collected (in a FIFO buffer) immediately preceding receipt of an instrument trigger.

Using This Command Reference

Commands Shown in Brackets [ ]

In this manual, commands and command separators shown between brackets, [COMMand:], are optional. Therefore, these portions of the commands may be used in your program command strings, but are not required for proper operation of the 58542 VXI Power Meter.

Programmer Selectable Parameters < >

Command descriptions use the less than, < , and greater than, > , signs to show the syntax placement of configurable/settable parameters. Between these symbols you will find a description of the necessary parameter and the range of values/mnemonics which are valid for that parameter.

Italics Type in Syntax Descriptions *space*

Some command syntax descriptions show certain words in italics. Words shown in italics type such as *space* or *comma* indicate where a space, " ", or a comma " , " must be included within a command string.

Query Format ?

Except where specifically noted, all commands have a convenient syntax for query commands. A query is formed by adding a question mark,"?", to the command header. Be sure to omit command parameters when you are using the query format. Some commands have only a query format.

With the exception of the CALibration queries, sending query commands will not change the status of the 58542 VXI Power Meter. The CALibration1? and CALibration1:ZERO? queries automatically begin the 58542s' calibration and zeroing process, respectively.

Linking Command Strings

The 58542 VXI Power Meter uses ASCII strings for commands. When sending more than one command in a single string, a semi-colon must be used as a delimiter between commands. No spaces or other characters are necessary. Use only a semi-colon, " ; ", to link commands in a string.

Measurement Data Output Format

Examples

The examples shown in this chapter are written in HTBasic™ format. Different languages will use different commands, but the string sent or received will always be the same. In HTBasic, the OUTPUT command sends a string to the GPIB bus. The number or variable after the word "OUTPUT" is the GPIB address of the instrument.

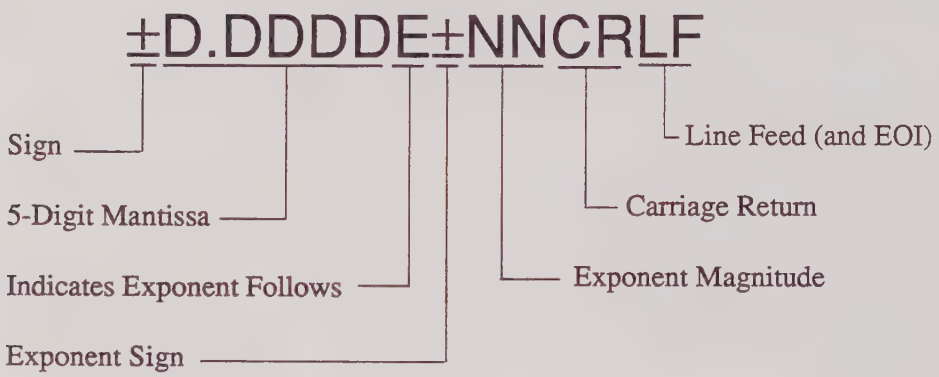


Figure 3-5. Measurement Data Output Format

™ HTBasic is a trademark of TransEra Corporation.

58542 VXI Power Meter Command Syntax Reference

Table 3-A. Alphabetical Command Syntax , Example , Function, and Description Location

NOTE: This table lists (in alphabetical order) all of the VXI GPIB commands supported by the Model 58542 VXI Power Meter. A typical example is shown, the basic function performed by that command is given, and the page numbers of this chapter are shown where descriptions of each command can be located.

Command Syntax Typical Example	Function	Page Number
ABORt		
OUTPUT @Pwr_mtr;"ABOR"	! Halts measurement & triggering	3-110
CALCulate<channel 1 or 2>:DATA?		
OUTPUT @Pwr_Mtr;"CALC1:DATA?"	! Query channel 1 & 2 burst mode data	3-69
Response is comma delimited data. Number of points equals # from "TRIG:COUN #". 0<#<128000.		
CALCulate<channel 1 or 2>[:CHANnel]:DIFFerence*space*<sensor 1 or 2*comma*sensor 2 or 1>		
OUTPUT @Pwr_Mtr;"CALC1:DIFF 2,1"	! Configures channel 1 to measure ! Sensor 2 minus Sensor 1 power	3-55
CALCulate<channel 1 or 2>[:FUNCtion]?		
OUTPUT@Pwr_mtr;"CALC2?"	! Query channel 2 sensor mode	3-56
Response is: "POW 1", "POW 2", "RAT 2,1", "RAT 2,1", "DIFF 1,2", or "DIFF 2,1"		
CALCulate<channel 1 or 2>:LIMit:CLEar[:IMMediate]		
OUTPUT @Pwr_mtr;"CALC1:LIM:CLE"	! Reset channel 1 limit violation ! indicator to "0".	3-103
CALCulate<channel 1 or 2>:LIMit:FCOunt?		
OUTPUT@Pwr_mtr;"CALC1:LIM:FCO?"	! Query number of channel 1 limit failures	3-104
Response is a single number - the number of times the limit lines were exceeded.		
CALCulate<channel 1 or 2>:LIMit:FAIL?		
OUTPUT @Pwr_mtr;"CALC1:LIM:FAIL?"	! Check for channel 1 limit line violation (Output "0" = OK; "1" = fail)	3-104
CALCulate<channel 1 or 2>:LIMit:LOWer*space*<numeric value in dB from -299.99 to 299.99>		
OUTPUT @Pwr_mtr;"CALC1:LIM:LOW -50.0"	! Set channel 1 lower limit line to -50 dBm	3-104
CALCulate<channel 1 or 2>:LIMit:LOWer?		
OUTPUT @Pwr_mtr;"CALC1:LIM:LOW?"	! Query channel 1 lower limit line setting	3-104
Response is a single number - the lower limit setting.		
CALCulate<channel 1 or 2>:LIMit:STATe*space*<ON or OFF>		
OUTPUT @Pwr_mtr;"CALC1:LIM:STAT ON"	! Enable channel 1 upper and lower limit ! checking. ("0" = off; "1" = on)	3-104
CALCulate<channel 1 or 2>:LIMit:STATe?		
OUTPUT @Pwr_mtr;"CALC1:LIM:STAT?"	! Query channel 1 ON or OFF status	3-105
Response is a "1" or "0", for ON or OFF, respectively.		

Command Syntax Typical Example	Function	Page Number
CALCulate<channel 1 or 2>:LIMit:UPPer*space***<numeric value in dB from -299.99 to 299.99>**		
OUTPUT @Pwr_mtr;"CALC1:LIM:UPP 17.0"	! Set channel 1 upper limit line to 17 dBm	3-105
CALCulate<channel 1 or 2>:LIMit:UPPer?		
OUTPUT @Pwr_mtr;"CALC1:LIM:UPP?"	! Query channel 1 upper limit line setting	3-105
Response is a single number - the upper limit setting.		
CALCulate<channel 1 or 2>[:CHANnel]:POWer*space***<sensor 1 or 2>**		
OUTPUT @Pwr_Mtr;"CALC2:POW 1"	! Configures channel 2 to ! measure Sensor 1 power	3-55
CALCulate<channel 1 or 2>[:CHANnel]:RATio*space***<sensor 1 or 2***comma***sensor 2 or 1>**		
OUTPUT @Pwr_Mtr;"CALC1:RAT 2,1"	! Configures channel 1 to measure ! Sensor 2 over Sensor 1 power	3-55
CALCulate<channel 1 or 2>:MODE*space* **<NORMal, BURSt, or SWIFt Mode Selection>**		
OUTPUT@Pwr_mtr;"CALC2:MODE SWIF"	! Set measurement mode to SWIFt	3-70
CAUTION: This command sets operating mode for both channels regardless of CALC# 1 or 2.		
CALCulate<channel 1 or 2>:MODE?		
OUTPUT@Pwr_mtr;"CALC1:MODE?"	! Query channel 1 measurement mode	3-71
Response is a "NORM", "BURS", or "SWIF".		
CALCulate<channel 1 or 2>:MAXimum:STATe*space***<ON or OFF>**		
OUTPUT@Pwr_mtr;"CALC2:MAX:STAT ON"	! Enable channel 2 max. value monitoring	3-101
CALCulate<channel 1 or 2>:MAXimum:STATe?		
OUTPUT@Pwr_mtr;"CALC2:MAX:STAT?"	! Query channel 2 max. mon. ON/OFF status	3-101
Response is a "1" or "0", for ON or OFF, respectively.		
CALCulate<channel 1 or 2>:MAXimum[:MAGnitude]?		
OUTPUT@Pwr_mtr;"CALC2:MAX?"	! Query channel 2 maximum value in dBm	3-101
Response is highest power reading since "CALC2:MAX:STAT ON" was sent.		
CALCulate<channel 1 or 2>:MINimum:STATe*space***<ON or OFF>**		
OUTPUT@Pwr_mtr;"CALC1:MIN:STAT ON"	! Enable channel 1 min. value monitoring	3-102
CALCulate<channel 1 or 2:MINimum:STATe?		
OUTPUT@Pwr_mtr;"CALC1:MIN:STAT?"	! Query channel 1 min. mon. ON/OFF status	3-102
Response is a "1" or "0", for ON or OFF, respectively.		
CALCulate<channel 1 or 2>:MINimum [:MAGnitude]?		
OUTPUT@Pwr_mtr;"CALC1:MIN?"	! Query channel minimum value in dBm	3-102
Response is lowest power reading since "CALC2:MIN:STAT ON" was sent.		
CALCulate<channel 1 or 2>:REFerence:STATe*space***<ON or OFF>**		
OUTPUT @Pwr_mtr;"CALC2:REF:STAT ON"	! Activate level reference for relative ! measurements	3-87

Command Syntax

Typical Example	Function	Page Number
CALCulate<channel 1 or 2>:REFerence:STATe?		
OUTPUT @Pwr_mtr;"CALC2:REF:STAT?"	! Query ON or OFF status ("0" = off; "1" = on)	3-87
Response is a "1" or "0", for ON or OFF, respectively.		
CALCulate<channel 1 or 2>:REFerence [:MAGnitude] <dB Offset value form -299.999 to 299.999>		
OUTPUT@Pwr_mtr;"CALC2:REF -30.11"	! Set channel 2 reference offset value in dB	
OUTPUT@Pwr_mtr;"CALC2:REF 0.00"	! Re-set channel 2 Relative meas. operation	3-87
CALCulate<channel 1 or 2>:REFerence [:MAGnitude]?		
OUTPUT @Pwr_Mtr;"CALC1:REF?"	! Query current channel 1 reference value	3-88
Response is a single number reporting the reference value.		
CALCulate<channel 1 or 2>:REFerence:COLLect		
OUTPUT @Pwr_mtr;"CALC2:REF:COLL" ! Current Rdg. ==> Ref level.	! Take channel 2 reading as ! reference value. Reset with CALC:REF 0.0	3-88
CALCulate<channel 1 or 2>:STATE*space*<ON or OFF>		
OUTPUT@Pwr_mtr;"CALC1:STAT OFF"	! Disable channel 1 measurement	3-56
CALCulate<channel 1 or 2>:STATe?		
OUTPUT@Pwr_mtr;"CALC1:STAT?"	! Query channel 1 measurement status ("0" = off; "1" = on)	3-56
Response is a "1" or "0", for ON or OFF, respectively.		
CALCulate<channel 1 or 2>:UNIT[:POWer]*space*<data units selection, DBM or Watt>		
OUTPUT @Pwr_Mtr;"CALC1:UNIT W"	! Selects channel 1 Linear Units, Watts	
OUTPUT @Pwr_Mtr;"CALC1:UNIT DBM"	! Selects channel 1 Log Units, dBm	3-56
CALCulate<channel 1 or 2>:UNIT[:POWer]?		
OUTPUT @Pwr_Mtr;"CALC1:UNIT?"	! Query channel 1 Units Configuration	3-56
Response is "DBM" or "W".		
CALibrate<sensor 1 or 2> [:SENSor]		
OUTPUT @Pwr_mtr;"CAL1"	! Calibrate Sensor 1	3-19
CALibrate<sensor 1 or 2> [:SENSor]?		
OUTPUT @Pwr_mtr;"CAL1?"	! Cal. Sensor 1 & return Pass/Fail status ("0" = pass; "1" = fail)	3-19
Response is a "1" or "0" immediately upon power sweep calibration failure or completion, respectively.		
CALibrate<sensor 1 or 2>:ZERO		
OUTPUT @Pwr_mtr;"CAL1:ZERO"	! Zero Sensor 1	3-20
CALibrate<sensor 1 or 2>:ZERO?		
OUTPUT @Pwr_mtr;"CAL1:ZERO?"	! Zero Sensor 1 & return Pass/Fail status	3-20
Response is a "1" or "0" immediately upon power sensor zeroing failure or completion, respectively.		
CALibrate<sensor 1 or 2>:STATe?		
OUTPUT @Pwr_mtr;"CAL1:STAT?"	! Query sensor for calibration status	3-21
Response is a "1" if sensor is calibrated, or "0" if sensor is not calibrated.		

Command Syntax Typical Example	Function	Page Number
***CLS**		
OUTPUT @Pwr_mtr:"*CLS"	! Clear srq and status byte registers	3-93
***ESE*space*<event status register value, 0 to 255>**		
OUTPUT @Pwr_Mtr;"*ESE 16"	! Enable bit 4 of event status register mask	3-93
***ESE?**		
OUTPUT @Pwr_Mtr;"*ESE?"	! Query currently enabled bits of ! event status register mask	3-93
Response is the sum of the enabled bit numbers, n, from 0 to 7 expressed as the sum of the enabled 2^n.		
***ESR?**		
OUTPUT @Pwr_Mtr;"*ESR?"	! Return event status register value	3-94
Response is the sum of the active bit numbers, n, from 0 to 7 expressed as the sum of the enabled 2^n.		
FETCh<channel 1 or 2>?		
OUTPUT @Pwr_Mtr;"FETC1?"	! Read previously triggered channel 1 power, ! Normal, Swift, or Burst mode data.	3-31
***IDN?**		
OUTPUT @Pwr_Mtr;"*IDN?"	! Query instrument mfgr & model #	3-114
Response is "Giga-tronics, 58542,0,#.##" where #.## is the software version.		
INITiate[:IMMediate]		
OUTPUT @Pwr_Mtr;"INIT"	! Initiate instrument triggering cycle	3-49
INITiate:CONTinuous*space*<ON or OFF>		
OUTPUT @Pwr_mtr;"INIT:CONT ON"	! 58542 self-triggers continuously	3-48
INITiate:CONTinuous?		
OUTPUT @Pwr_mtr;"INIT:CONT?"	! Query ON or OFF status. ("1" = on; "0" = off)	3-48
Response is a "1" or "0", for ON or OFF, respectively.		
MEASure<channel 1 or 2>[:SCALar:POWer]?		
OUTPUT @Pwr_Mtr;"MEAS2?"	! Configure triggering and measure Channel 2 ! power in NORMal mode.	3-31
MEMory[:TABLe]:CHANnel*space*<channel 1 or 2>		
OUTPUT@Pwr_mtr;"MEM:CHAN 2"	! Set analog out to channel 2	3-106
MEMory[:TABLe]:CHANnel?		
OUTPUT@Pwr_mtr;"MEM:CHAN?"	! Query analog out channel number	3-106
Response is channel "1" or channel "2".		
MEMory[:TABLe]:FREQuency < Start frequency>		
OUTPUT@Pwr_mtr;"MEM:FREQ 1e9"	! Set v_prop_f start frequency to 1 GHz	3-61
MEMory[:TABLe]:FREQuency?		
OUTPUT@Pwr_mtr;"MEM:FREQ?"	! Query v_prop_f start frequency	3-61
Response is the frequency value you set that corresponds to your source's VpropF output at 0.0V.		

Command Syntax Typical Example	Function	Page Number
MEMory[:TABLe]:POWer*space*<start value from -80 to +20 dBm>*comma*<stop value from -80 to +20 dBm>		
OUTPUT@Pwr_mtr;"MEM:POW -70,20"	! Set analog out power range (in dBm) ! from -70 to 20 dBm	3-107
MEMory[:TABLe]:POWer?		
OUTPUT@Pwr_mtr;"MEM:POW?"	! Query analog out power range	3-108
Response is two dBm values separated by a comma indicating analog output range.		
MEMory[:TABLe]:POWer*space*<start value from 0 to 0.01W>*comma*<stop value from 0 to 0.01W>		
OUTPUT@Pwr_mtr;"MEM:POW 0,1e-2"	! Set analog out power range (in Watts) ! from 0 to 0.01 Watts	3-107
MEMory[:TABLe]:POWer?		
OUTPUT@Pwr_mtr;"MEM:POW?"	! Query analog out power range	3-107
Response is two Watt values separated by a comma indicating analog output range.		
MEMory[:TABLe]:SELect*space*<ANALOGout,VPROPF1,VPROPF2>		
OUTPUT@Pwr_mtr;"MEM:SEL VPROPF1"	! Select memory table VPROPF1 ! for editing in following lines	3-60 / 106
MEMory[:TABLe]:SELect?		
OUTPUT@Pwr_mtr;"MEM:SEL?"	! Query selected memory table	3-60 / 106
Response is the table currently editable ANALOGout,VPROPF1,or VPROPF2.		
MEMory[:TABLe]:SLOPe*space*<Volts per Hz>		
OUTPUT@Pwr_mtr;"MEM:SLOP 1e-9"	! Set v_prop_f slope in 1V/GHz	3-60
MEMory[:TABLe]:SLOPe?		
OUTPUT@Pwr_mtr;"MEM:SLOP?"	! Query v_prop_f slope value	3-61
Response is the voltage to frequency value you set that corresponds to your source's VpropF output.		
MEMory[:TABLe]:UNIT*space*<Units for analog output comfiguration, DBM or Watt>		
OUTPUT@Pwr_mtr;"MEM:UNIT DBM"	! Set analog out power unit	3-107
MEMory[:TABLe]:UNIT?		
OUTPUT@Pwr_mtr;"MEM:TABL:UNIT?"	! Query analog out power unit	3-107
Response is the units used for analog output configuration, DBM or W.		
MEMory[:TABLe]:VOLTage*space*<start value from -10 to +10V>*comma*<stop value from -10 to +10V>		
OUTPUT@Pwr_mtr;"MEM:VOLT -8,2"	! Set analog out voltage range from ! -8 to 2 volts corresponding to power	3-108
MEMory[:TABLe]:VOLTage?		
OUTPUT@Pwr_mtr;"MEM:VOLT?"	! Query analog out voltage range	3-108
Response is two Voltage values separated by a comma indicating analog output range.		
***OPC**		
OUTPUT @Pwr_mtr;"*OPC"	! *OPC allows one time srq enable	3-32 / 94

Command Syntax Typical Example	Function	Page Number
***OPC?**		
OUTPUT @Pwr_mtr;"*OPC?"	! send a "1" upon operation complete	3-32 / 94
Response to this one time operation complete query is a "0" or a "1"..		
OUTPut[:BNC]:ANAlog[:STATe]*space*<ON or OFF>		
OUTPUT@Pwr_mtr;OUTP:ANA ON"	! Enable analog out function	3-108
OUTPut[:BNC]:ANAlog[:STATe]?		
OUTPUT@Pwr_mtr;OUTP:ANA?"	! Query analog out function status	3-108
Response is a "1" or "0", for ON or OFF, respectively.		
OUTPut:ROSCillator[:STATe]*space*<ON or OFF>		
OUTPUT @Pwr_mtr;"OUTP:ROSC ON"	! Turn ON 0.0 dBm Calibrator Oscillator	3-121
OUTPut:ROSCillator[:STATe]?		
OUTPUT @Pwr_mtr;"OUTP:ROSC?"	! Query ON or OFF status.	3-121
Response is a "1" or "0", for ON or OFF, respectively.		
***RCL*space*<memory location number, 0 to 20>**		
OUTPUT @Pwr_mtr;"*RCL 19"	! Recall 58542 register 19	3-109
READ<channel 1 or 2>[:POWer]?		
OUTPUT @Pwr_Mtr;"READ2?"	! Trigger measurement and read Channel 2	3-32
***RST**		
OUTPUT @Pwr_mtr;"*RST"	! Reset 58542 configuration	3-111
***SAVe*space*<memory location number, 1 to 20>**		
OUTPUT @Pwr_mtr;"*SAV 20"	! Save at 58542 register 20	3-109
SENSe<sensor 1 or 2>:AVERage:COUNt*space*<averaging value 1,2,4,8,16,32,64,128,256,or 512>		
OUTPUT @Pwr_mtr;"SENS1:AVER:COUN 16"	! Set sensor 1 average number to 16	3-85
SENSe<sensor 1 or 2>:AVERage:COUNt?		
OUTPUT @Pwr_mtr;"SENS1:AVER:COUN?"	! Query sensor 1 current averaging value.	3-85
Response is a "1", "2", "4", "8", "16", "32", "64", "128", "256", or "512".		
SENSe<sensor 1 or 2>:AVERage:COUNt:AUTO*space*<ON or OFF>		
OUTPUT @Pwr_mtr;"SENS2:AVER:COUN:AUTO ON"	! Select sensor 2 Auto-Average mode	3-85
SENSe<sensor 1 or 2>:AVERage:COUNt:AUTO?		
OUTPUT @Pwr_mtr;"SENS2:AVER:COUN:AUTO?"	! Query sensor 2 Auto-Average mode ! ON or OFF status	3-86
Response is a "1" or "0", for ON or OFF, respectively.		
SENSe<sensor 1 or 2>:AVERage:TCONtrol*space*<data acquisition averaging method, MOVing or REPeat>		
OUTPUT @Pwr_mtr;"SENS1:AVER:TCON REP"	! Set sensor 1 to acquire fresh ! measurement data before averaging	3-86

Command Syntax Typical Example	Function	Page Number
SENSe<sensor 1 or 2>:AVERage:TCONtrol?		
OUTPUT@Pwr_mtr;"SENS1:AVER:TCON?" Response is "MOV" or "REP".	! Query sensor 1 average method	3-86
SENSe<sensor 1 or 2>:CORRection:EEPROM:TYPE?		
OUTPUT@Pwr_mtr;"SENS1:CORR:EEPROM:TYPE?" Response is two integer numbers separated by a comma indicating model number and serial number.	! Query sensor 1 eeprom type	3-123
SENSe<sensor 1 or 2>:CORRection:EEPROM:FREQuency?		
OUTPUT@Pwr_mtr;"SENS1:CORR:EEPROM:FREQ?" Response is a series of comma delimited frequency values. Number of values is sum of the number of standard sensor frequency calibration factors and the number of special frequency calibration factors.	! Query sensor 1 eeprom frequency ! table	3-123
SENSe<sensor 1 or 2>:CORRection:EEPROM:CALFactor?		
OUTPUT@Pwr_mtr;"SENS1:CORR:EEPROM:CALF?" Response is a series of comma delimited sensor frequency calibration factors or Cal Factors. Cal Factors correspond to the frequencies in the output of "SENS#:CORR:EEPROM:FREQ?".	! Query sensor 1 eeprom cal factor ! table	3-123
SENSe<sensor 1 or 2>:CORRection:FREQuency[:CW-FIXed] 5e7		
OUTPUT@Pwr_mtr;"SENS2:CORR:FREQ 5e7"	! Set sensor 2 frequency to 50 MHz	3-59
SENSe<sensor 1 or 2>:CORRection:FREQuency?		
OUTPUT @Pwr_Mtr;"SENS1:CORR:FREQ?" Response is a single frequency in Hz which is the frequency of the signal incident upon the sensor.	! Query sensor 1 current frequency ! value	3-59
SENSe<sensor 1 or 2>:CORRection:OFFSet:COLLect		
OUTPUT@Pwr_mtr;"SENS1:CORR:OFFS:COLL"	! Take sensor 1 current reading as ! offset value	3-91
SENSe<sensor 1 or 2>:CORRection:OFFSet[:MAGnitude]*space*<offset value in dB, -99.99 to 99.99>		
OUTPUT @Pwr_Mtr;"SENS2:CORR:OFFS 10.2"	! Compensate sensor 2 for 10.2 dB ! attenuation	3-91
SENSe<sensor 1 or 2>:CORRection:OFFSet[:MAGnitude]?		
OUTPUT @Pwr_Mtr;"SENS2:CORR:OFFS?" Response is a single value in dB for the sensor's offset value.	! Query sensor 2 offset value	3-91
SENSe<sensor 1 or 2>:CORRection:OFFSet:STATe*space*<ON or OFF>		
OUTPUT @Pwr_Mtr;"SENS2:CORR:OFFS:STAT ON"	! Enable sensor 2 offset correction	3-91
SENSe<sensor 1 or 2>:CORRection:OFFSet:STATe?		
OUTPUT @Pwr_Mtr;"SENS2:CORR:OFFS:STAT?" Response is a "1" or "0", for ON or OFF, respectively.	! Query sensor 2 offset function status	3-92
SENSe<sensor 1 or 2>:CORRection:VPROpf[:STATe]*space* <ON or OFF>		
OUTPUT@Pwr_mtr;"SENS1:CORR:VPRO: ON"	! Enable sensor 1 v_prop_f function	3-61

Command Syntax Typical Example	Function	Page Number
SENSe<sensor 1 or 2>:CORRection:VPROpf[:STATe]?		
OUTPUT@Pwr_mtr;"SENS1:CORR:VPRO?" Response is a "1" or "0", for ON or OFF, respectively.	! Query v_prop_f function status	3-61
SENSe<sensor 1 or 2>:TEMPerature?		
OUTPUT@Pwr_mtr;"SENS1:TEMP?"	! Query sensor 1 temperature (in centigrade)	3-20
SENSe<sensor 1 or 2>:TRIGger:SOURce*space* **<PEak Sensor triggering INTernal, EXTernal, or CW>**		
OUTPUT@Pwr_mtr;"SENS1:TRIG:SOUR CW"	! Set sensor 1 peak trigger mode to CW mode	3-82
SENSe<sensor 1 or 2>:TRIGger:SOURce?		
OUTPUT@Pwr_mtr;"SENS1:TRIG:SOUR?" Response is "INT", "EXT", or "CW".	! Query sensor 1 peak trigger mode	3-82
SENSe<sensor 1 or 2>:TRIGger:DELay[:MAGnitude]:*space* **<Peak Sensor sample delay in seconds from -20e-9 to 104e-3>**		
OUTPUT@Pwr_mtr;"SENS1:TRIG:DEL 1e6"	! Set sensor 2 peak delay value to 1e6 seconds	3-83
SENSe<sensor 1 or 2>:TRIGger:DELay[:MAGnitude]?		
OUTPUT@Pwr_mtr;"SENS1:TRIG:DEL?" Response is Peak Sensor sample delay in seconds from 20e-9 to 104e-3.	! Query sensor 1 peak delay value	3-83
SENSe<sensor 1 or 2>:TRIGger:DELay:STATe*space***<ON or OFF>**		
OUTPUT@Pwr_mtr;"SENS1:TRIG:DEL:STAT ON"	! Enable peak sensor 1 delay function	3-83
SENSe<sensor 1 or 2>:TRIGger:DELay:STATe?		
OUTPUT@Pwr_mtr;"SENS1:TRIG:DEL:STAT?" Response is a "1" or "0", for ON or OFF, respectively.	! Query peak sensor 1 delay function	3-83
SENSe<sensor 1 or 2>:TRIGger:LEVel[:MAGnitude]*space***<trigger level of peak power sensor. In EXT triggering use 0.1 to 5.1V. In INT triggering use -30 to +20 dBm>**		
OUTPUT@Pwr_mtr;"SENS1:TRIG:LEV 1.7"	! Set peak sensor 1 trigger level to 1.7 volts	3-83
SENSe<sensor 1 or 2>:TRIGger:LEVel[:MAGnitude]?		
OUTPUT@Pwr_mtr;"SENS1:TRIG:LEV?" Response is the current peak power sensor trigger level setting - a single value in Volts or dBm.	! Query peak sensor 1 trigger level	3-84
SENSe<sensor 1 or 2>:TRIGger:OFFSet[:MAGnitude]		
OUTPUT@Pwr_mtr;"SENS1:TRIG:OFFS 0"	! Set peak sensor 1 trigger offset time to 0 second	3-84
SENSe<sensor 1 or 2>:TRIGger:OFFSet[:MAGnitude]?		
OUTPUT@Pwr_mtr;"SENS1:TRIG:OFFS?" Response is the current peak power sensor trigger offset setting - a single value in seconds	! Query peak sensor 1 trigger offset time	3-84
SENSe<sensor 1 or 2>:TRIGger:TOTAl[:MAGnitude]?		
OUTPUT@Pwr_mtr;"SENS1:TRIG:TOTA?" Response is the current peak power sensor total trigger delay setting - a single value in seconds	! Query peak sensor 1 total trigger delay time	3-84
SREspace***<event status register value, 128, 64, 32,16,8,4,2,1>**		
OUTPUT @Pwr_mtr;"*SRE 32"	! Enable bit 5 of Status Byte register	3-94

Command Syntax Typical Example	Function	Page Number
***SRE?**		
OUTPUT @Pwr_mtr;"*SRE?"	! Query Bits Enabled of Status Byte register	3-94
Response is the status register mask value		
STATus:OPERation[:EVENt]?		
OUTPUT@Pwr_mtr;"STAT:OPER?"	! Query operation event register result	3-94
Response is Operation Status Register value. Sum of on bits 0 to 14 expressed as 2^n.		
STATus:PRESet		
OUTPUT @Pwr_mtr;"STAT:PRES"	! Clears all the status register value	3-95 / 111
***STB?**		
OUTPUT @Pwr_mtr:"*STB?"	! Query status byte register	3-95
Response is status byte value. Sum of on bits 0 to 7 expressed as 2^n.		
SYSTem:ERRor?		
OUTPUT @Pwr_mtr;"SYST:ERR?"	! Query system error message	3-129
Response is an error number value followed by a comma followed by an error information string in quotes.		
SYSTem:PRESet		
OUTPUT @Pwr_mtr;"SYST:PRES"	! Reset 58542 configuration	3-111
SYSTem:VERSion?		
OUTPUT @Pwr_mtr;"SYST:VERS?"	! Query SCPI version.	3-114
Response is the SCPI command set version, "1990.0".		
***TRG**		
OUTPUT @Pwr_mtr;"*TRG"	! VXI cont. BUS Trigger Event	3-44
TRIGger[:IMMediate]		
OUTPUT@Pwr_mtr;"TRIG:IMM"	! Trigger measurement cycle	3-44
TRIGger:SOURce*space***<instrument triggering source IMMediate, BUS, HOLD, or EXTernal>**		
OUTPUT@Pwr_mtr;"TRIG:SOUR IMM"	! Set instrument measurement trigger ! source to IMMediate	3-44
TRIGger:SOURce?		
OUTPUT @Pwr_mtr;"TRIG:SOUR?"	! Set instrument measurement trigger ! source	3-45
Response is instrument triggering source" IMM", "BUS", "HOLD", or "EXT".		
TRIGger:MODE*space***<burst mode data gathering POST trigger receipt or PRE trigger receipt>**		
OUTPUT@Pwr_mtr;"TRIG:MODE POST"	! Set Burst or Swift mode data collection ! relative to Timing of event trigger post	3-45
TRIGger:MODE?		
OUTPUT @Pwr_mtr;"TRIG:MODE?"	! Query Burst or Swift mode returns ! PRE or POST	3-45
Response is "PRE" or "POST".		

Command Syntax Typical Example	Function	Page Number
TRIGger:DELay*space*<delay time between buffered readings in sec, 0.000 to 5.000>		
OUTPUT @Pwr_mtr;"TRIG:DEL 5e-3"	! Set Burst mode measurement time to ! 5 ms between measurements.	
OUTPUT @Pwr_mtr;"TRIG:DEL 0"	(resolution, one msec)	3-46
TRIGger:DELay?		
OUTPUT @Pwr_mtr;"TRIG:DEL?"	! Query Burst mode measurement time ! returns delay value	3-46
Response is a single number indicating the number of seconds between readings. Resolution to 0.001.		
TRIGger:COUNt*space*<number of data values to buffer in memory from 1 to 5000 for standard 58542s, from 1 to 128,000 on one channel with option 02 and 1 to 64000 for two channels with option 02>		
OUTPUT@Pwr_mtr;"TRIG:COUN 100"	! Set Burst or Swift mode buffer reading ! number to 100	3-46
TRIGger:COUNt?		
OUTPUT@Pwr_mtr;"TRIG:COUN?"	! Query Burst or Swift mode buffer ! number	3-47
Response is a single number - the number of data points stored in memory during Burst or Swift modes.		
***TST?**		
OUTPUT@Pwr_mtr;"*TST?"	! Query self-test result	3-124
Response is a "0" when self test passes.		
***WAI**		
OUTPUT @Pwr_mtr;"*WAI"	! Wait, following command completion	3-47

Sensor Calibration and Zeroing

CALibrate<sensor 1 or 2>
CALibrate<sensor 1 or 2>:ZERO
CALibrate<sensor 1 or 2>:STATe?
SENSe<sensor 1 or 2>:TEMPerature

SENSOR CALIBRATION

The CALibration commands for sensor calibration and zeroing are important for accurate power measurement results. Be sure to perform the sensor calibration prior to beginning measurement operation or channel configuration. Sensors must be calibrated to the meter before performing measurements.

Zeroing of all active sensors should ***always*** be performed whenever a second sensor (whether calibrated or not) is added or removed. Zeroing should also be performed prior to measurement of low signal levels - generally within the lower 15 dB of a sensor's dynamic range. For Standard Sensors, this is -55 dBm.

CAL#

CALibration<sensor 1 or 2> [:SENSor]

OUTPUT @Pwr_mtr;"CAL1" ! Calibrate Sensor 1

DESCRIPTION

This command will begin the sensor power sweep calibration process. Power sweep calibration can only be performed during Normal mode. The sensor must be attached to the front panel "CALIBRATOR" (use an adapter for high frequency sensors with Type K connectors). If the sensor is not connected or if the sensor is disconnected during the power sweep calibration procedure, the calibration automatically fails and the sensor power sweep calibration table is restored to its previous values.

CAL#?

CALibration<sensor 1 or 2> [:SENSor]?

OUTPUT @Pwr_mtr;"CAL1?" ! Cal. Sensor 1 & return Pass/Fail status

Response is **"0"** = pass; **"1"** = fail

DESCRIPTION

This command executes the same procedure as above except a pass fail flag is automatically output at either the completion of power sweep calibration or detection of failure. A "0" indicates a successful completion of power sweep calibration for the sensor attached to the calibrator port or a cable leading to the calibrator port. A "1" indicates that something has caused a failure. The most common cause is forgetting to connect the sensor to the calibrator.

CALibrate<sensor 1 or 2>:STATe?
OUTPUT @Pwr_mtr;"CAL1:STAT?" ! Query sensor for calibration status
Response is a "1" if sensor is calibrated, or "0" if sensor is not calibrated.

DESCRIPTION
This command can be used to determine whether or not a particular sensor has been calibrated.

SENSOR ZEROING

Zeroing automatically accounts for ground noise and other noise in your measurement system. Measurements will be sensitive to noise induced errors only in the lowest 15 dB of the sensor dynamic range. Be sure to turn off the signal going into the sensor during zeroing, otherwise a failure will be indicated.

CAL#:ZERO

CALibration<sensor 1 or 2>:ZERO
OUTPUT @Pwr_mtr;"CAL1:ZERO" ! Zero Sensor 1

DESCRIPTION
This command begins the zeroing process. Since you want to offset for measurement circuit noise during zeroing, you want the sensor to remain attached to the measurement circuit during zeroing. Disable the signal source into the sensor. If you cannot disable the signal source, connect the sensor to a grounded connector (preferably RF grounded) or leave the sensor disconnected. Do not connect the sensor to the power meter's front panel calibrator port. If the meter detects excessive RF power at the start of the zeroing process (generally above -50 dBm for standard sensors), zeroing will automatically fail.

CAL#:ZERO?

CALibration<sensor 1 or 2>:ZERO?
OUTPUT @Pwr_mtr;"CAL1:ZERO?" ! Zero Sensor 1 & return Pass/Fail status
Response is **"0"** = pass; **"1"** = fail

DESCRIPTION
This command executes the same procedure as above except a pass/fail flag is automatically output at either the completion of zeroing or detection of failure. A "0" indicates successful zeroing. A "1" indicates that something has caused a failure. The most common cause is not turning off the source power before beginning the zeroing process.

SENS#:TEMP?

SENSe<sensor 1 or 2>:TEMPerature?
OUTPUT@Pwr_mtr;"SENS1:TEMP?" ! Query sensor 1 temperature (in centigrade)
Response is current sensor temperature in degrees centigrade

DESCRIPTION
This command reports sensor temperature. If the temperature varies in your operating environment, monitor the relative temperature variations. If the variation since the previous power sweep calibration exceeds ±5 degrees celcius (±9°F), re-perform the power sweep calibration for that sensor.

Sensor Calibration Examples

Sensors must be calibrated to the meter before performing measurements. Only one sensor at a time can be calibrated to a given 58542 VXI Power Meter input. That is, each time a sensor is calibrated to the meter using the power sweep calibration, previous calibrations for that meter input are voided automatically. Thus, you are assured that your measurement system is always performing under a valid sensor calibration.

The following example performs power sweep calibration of the power sensor connected to input number 2 and sends back a pass/fail flag upon completion using CAL2?.

```
410  ASSIGN @Pwr_mtr to 70101
420  CLEAR @Pwr_mtr
430  WAIT 1
440   PRINT "Connect the sensor to the power sensor cable."
450   INPUT "Then connect the sensor to the calibrator and hit ENTER.",Dmy
460   PRINT "Calibrating Sensor 2..."
470    OUTPUT @Pwr_mtr;"CAL2?"
480    ENTER @Pwr_mtr;Pass_cal
490    IF Pass_cal=0 THEN PRINT "Calibration Passed"
500    IF Pass_cal=1 THEN
510     PRINT "Calibration FAILED, Sensor 2 on calibrator?"
560    ELSE
570     IF Pass_cal<>0 THEN PRINT "Strange Response to CAL2?.  Clear output Queue?"
580    END IF
590    !
```

The following program uses the CAL? query format to perform power sweep calibration of a power sensor and sends back a pass/fail flag upon completion. Completion of the calibration function is monitored via service requests using the *OPC, operation complete command.

> The 58542 power meter measurement functions are operated to tight tolerances during sensor calibration. If the sensor passes calibration, it is a good health check of the 58542 VXI Power Meter. In general, the power meter and sensors are operating properly if they pass the calibration process. For instance, the calibration process will fail if the sensor detector elements have been damaged. Also see the self test functions, which are initiated using the *TST command (see page 3-124) or the DIAG: commands (see Appendix B on page 6-11 of the Maintenance Chapter).

```
330  !
340  !########################################
350  !
360  !   CALIBRATE THE SENSORS
370  !
380  !########################################
390  ASSIGN @Pwr_mtr to 70101
400  CLEAR @Pwr_mtr
410  WAIT 1
420  OUTPUT @Pwr_mtr;"*CLS"          ! Clear status registers and error queue buffer
425  WAIT 0.3
430  OUTPUT @Pwr_mtr;"*ESE 1"        ! Standard Event Status Enable bit 0, Operation Complete
440  OUTPUT @Pwr_mtr;"*SRE 32"       ! Service Request Enable Status Byte bit 5, Standard
                                     ! Event Status Register
450  !
460  ON INTR 7 GOSUB Spoll_intr
470  ENABLE INTR 7;2
480   !
```

```
490  ! Calibration Routine
500  !
510  INPUT "Connect the sensor to the calibrator. Then press ENTER.",Dmy
520  PRINT "Calibrating Sensor 1..."
525   Srq_flag=0
530   OUTPUT @Pwr_mtr;"CAL1?;*OPC"                    ! For zeroing substitute CAL1:ZERO? for CAL1?
540   !
550   !
560   !  Now wait for srq
570   !
580   !
590   !
600  WHILE Srq_flag=0
610  END WHILE
620   !
630   ! Enter Pass/Fail Flag,  This comes with query format, CAL1?, rather than command format, CAL1.
640   !
650   ENTER @Pwr_mtr;Pass_cal
660   IF Pass_cal=0 THEN PRINT "Calibration Passed"
670   IF Pass_cal=1 THEN
680     OUTPUT @Pwr_mtr;"SYST:ERR?"
690     ENTER @Pwr_mtr;Err_msg$                       ! Reading an error message clears it.
700     PRINT "The power meter reports the following error.",Err_msg$
710     PRINT "Calibration FAILED, sensor on calibrator?"
720   ELSE
730     IF Pass_cal<>0 THEN PRINT "Strange Response to CAL1?. Other Event Status Register Bits Too?"
740   END IF
750   !
760   STOP
770   !
780 Spoll_intr:  !
790   !
800   State=SPOLL(@Pwr_mtr)
810   PRINT "SPOLL INTR:";State
820   Srq_flag=1
830   ENABLE INTR 7;2
840   !
850   RETURN
860   !
870  !
880  !          END OF SENSOR CAL
890  !################################################
900  !
910  END
```

The following program uses the CAL format to perform power sweep calibration of a power sensor. Completion of the calibration function is monitored via service requests using the *OPC, operation complete command. The Standard Event Status Register is used to report pass/fail by asserting bit 3, value 8, the Device Dependent Error bit.

```
320  !
330  !########################################
340  !
350  !   CALIBRATE THE SENSORS
```

```
360  !
370  !#######################################
380  !
390  ASSIGN @Pwr_mtr to 70101
400  CLEAR @Pwr_mtr
410  WAIT 1
420  OUTPUT @Pwr_mtr;"*CLS"                          ! Clear status registers and error queue buffer
425  WAIT 0.3
430  OUTPUT @Pwr_mtr;"*ESE 1"                        ! Standard Event Status Enable bit 0, Operation
                                                     ! Complete
440  OUTPUT @Pwr_mtr;"*SRE 32"                       ! Service Request Enable Status Byte bit 5,
                                                     ! Standard Event Status Register
450  !
460  ON INTR 7 GOSUB Spoll_intr
470  ENABLE INTR 7;2
480   !
490   ! Calibration Routine
500   !
510   INPUT "Connect the sensor to the calibrator. Then press ENTER.",Dmy
520   PRINT "Calibrating Sensor 1"
525   Srq_flag=0
530   OUTPUT @Pwr_mtr;"CAL1;*OPC"                    ! For zeroing substitute CAL1:ZERO for CAL1
540   OUTPUT @Pwr_mtr;"*OPC"                         ! If not sent with previous line, send *OPC here
550    !
560    !  Now wait for srq
570    !
580    !
590    !
600  WHILE Srq_flag=0
610  END WHILE
620   !
630   ! Enter Error Reporting From Standard Event Status Register
640   !
650    OUTPUT @Pwr_mtr;"*ESR?"
660    ENTER @Pwr_mtr;Esr
670    IF Esr=0 THEN PRINT "Operation was not completed. Also, no errors."
680    IF Esr=1 THEN
690     PRINT "Operation Completed.  No errors reported during CAL execution."
700    ELSE
710     IF Pass_cal<>0 THEN PRINT "Operation completed. An error has occured or power was just turned on."
720     OUTPUT @Pwr_mtr;"SYST:ERR?"
730     ENTER @Pwr_mtr;Err_msg$                     ! Reading an error message clears it
740     PRINT "The power meter reports the following error.",Err_msg$
750     PRINT "Calibration FAILED, sensor on calibrator?"
760     PRINT Esr
770    !
780    END IF
790    !
800    !
810    STOP
820    !
830 Spoll_intr:  !
840    !
850    State=SPOLL(@Pwr_mtr)
```

```
860   PRINT "SPOLL INTR:";State
870   Srq_flag=1
880   ENABLE INTR 7;2
890   !
900   RETURN
910 !
920 !
930 !          END OF SENSOR CAL
940 !##############################################
950 !
960 END
```

The following program prompts the operator to connect a return loss bridge for calibration and attach an open or short to the bridge test port. It then performs power sweep calibration, and sends back a pass/fail flag upon completion.

```
410  ASSIGN @Pwr_mtr to 70101
420  CLEAR @Pwr_mtr
430  WAIT 1
440   PRINT "Connect the 80503 Precision Return Loss Bridge to the input #2 power sensor cable."
445   PRINT "Connect the open or short calibration connector to the bridge test port."
450   INPUT "Then use an adapter to connect the bridge input port to the calibrator and hit ENTER.",Dmy
460   PRINT "Calibrating Sensor 2..."
470    OUTPUT @Pwr_mtr;"CAL2?"
480    ENTER @Pwr_mtr;Pass_cal
490    IF Pass_cal=0 THEN PRINT "Calibration Passed"
500    IF Pass_cal=1 THEN
510     PRINT "Calibration FAILED, Bridge connected to calibrator?"
560    ELSE
570     IF Pass_cal<>0 THEN PRINT "Strange Response to CAL2?.  Clear output Queue?"
580    END IF
590    !
```

The following program prompts the operator to remove the high power attenuator from a high power sensor main housing and connect the main housing to the power sweep calibrator port. It then performs power sweep calibration, and sends back a pass/fail flag upon completion.

```
410  ASSIGN @Pwr_mtr to 70101
420  CLEAR @Pwr_mtr
430  WAIT 1
440   PRINT "Connect the 80325 50W Power Sensor to the input #2 power sensor cable."
445   PRINT "Remove the high power attenuator or leave it attached to the measurement port on the DUT."
450   INPUT "Then connect the high power sensor main housing to the calibrator and hit ENTER.",Dmy
460   PRINT "Calibrating Sensor 2..."
470    OUTPUT @Pwr_mtr;"CAL2?"
480    ENTER @Pwr_mtr;Pass_cal
490    IF Pass_cal=0 THEN PRINT "Calibration Passed.  Re-attach the high power attenuator immediately!"
500    IF Pass_cal=1 THEN
510     PRINT "Calibration FAILED, Main sensor housing connected to calibrator?"
560    ELSE
570     IF Pass_cal<>0 THEN PRINT "Strange Response to CAL2?.  Clear output Queue?"
580    END IF
590    !
```

Sensor Zeroing Examples

The following example requests that the operator turn off the signal source or disconnect the sensor from the source prior to zeroing. It is preferable to disable the source and leave the sensor attached to the measurement port for proper zeroing. If the source cannot be disabled, use a switch or attach a connector to the grounded metal near your DUT measurement port. DO NOT attach the sensor to the power meter's calibrator port. You want the zeroing offset process to account for the DUT's ground plane noise and thermal emf's, not the power meter's.

```
410  ASSIGN @Pwr_mtr to 70101
420  CLEAR @Pwr_mtr
430  WAIT 1
440   INPUT "Disable the source's RF output or attach it to a grounded connector.  Then hit ENTER.",Dmy
450   PRINT "Zeroing Sensor 1"
460    OUTPUT @Pwr_mtr;"CAL1:ZERO?"
470    ENTER @Pwr_mtr;Pass_zer
480    IF Pass_zer=0 THEN PRINT "Zeroing Passed"
490    IF Pass_zer=1 THEN
500     PRINT "Zeroing FAILED, Source turned off?"
550    ELSE
560     IF Pass_zer<>0 THEN PRINT "Strange Response to CAL1:ZERO?.  Clear output Queue?"
570    END IF
580    !
```

The following program turns off the signal source, zeros the power sensor, reports a pass/fail indicator upon completion, and turns the source back on.

```
400  ASSIGN @Pwr_mtr to 70101
410  ASSIGN @Source to 70102
420  CLEAR @Pwr_mtr
430  WAIT 1
440   OUTPUT @Source "RF0"                    ! Turns source output power off ( < -90 dBm).
450   PRINT "Zeroing Sensor 1"
460    OUTPUT @Pwr_mtr;"CAL1:ZERO?"
470    ENTER @Pwr_mtr;Pass_zer
480    IF Pass_zer=0 THEN PRINT "Zeroing Passed"
490    IF Pass_zer=1 THEN
500     Ques$="Zeroing FAILED, Source turned off?"
510     OUTPUT @Pwr_mtr;"SYST:ERR?"
520     ENTER @Pwr_mtr;Err_msg$                ! Reading an error message clears it.
530     PRINT Err_msg$
540     PRINT Ques$
550    ELSE
560     IF Pass_zer<>0 THEN PRINT "Strange Response to CAL1:ZERO?.  Clear output Queue?"
570    END IF
580    !
590    OUTPUT @Source "RF1"                    ! Turns source output power back on.
```

Zeroing is recommended whenever you are performing critical final power measurements in the bottom 15 to 20 dB of a power sensors dynamic range. Zeroing removes zero drift error from your measurement. At higher power levels, zero drift is typically insignificant when compared to the other sources of error such as source/sensor mismatch uncertainty.

Error Control Examples

Selected basic SCPI syntax and execution errors apply to these commands.

The following command will operate properly.

```
460   OUTPUT @Pwr_mtr;"CAL1?"                    ! Calibrate channel 1
```

The following command is not a legal command. The 58542 only has two channels.

```
460   OUTPUT @Pwr_mtr;"CAL3?"                    ! Calibrate channel 3
```

If you ask for error information, the error reporting is as follows

```
.
510    OUTPUT @Pwr_mtr;"SYST:ERR?"
520    ENTER @Pwr_mtr;Err_msg$                    ! Reading an error message clears it.
530    PRINT Err_msg$
       Program Output:  -7,"Invalid Error Number"
```

The following command is not a legal command. The command is mis-typed.

```
460   OUTPUT @Pwr_mtr;"CALS?"                    ! Calibrate channel 3
```

If you ask for error information, the error reporting is as follows.

```
510    OUTPUT @Pwr_mtr;"SYST:ERR?"
520    ENTER @Pwr_mtr;Err_msg$                    ! Reading an error message clears it.
530    PRINT Err_msg$
       Program Output:  -113,"Undefined Header;CALS"
```

Device specific errors include the following.

```
-300,"Device-specific error;No Sensor"
```

The following examples demonstrate the conditions for various errors.

```
380  ASSIGN @Pwr_mtr to 70101
390  CLEAR @Pwr_mtr
400  WAIT 1
401   INPUT "Disconnect Sensor From Cable For Error Demonstration.  Then hit ENTER.",Dmy
410   PRINT "Calibrating Sensor 1"
420    OUTPUT @Pwr_mtr;"CAL1?"
430    ENTER @Pwr_mtr;Pass_cal
440    IF Pass_cal=0 THEN PRINT "Calibration Passed"
450    IF Pass_cal=1 THEN
460      Ques$="Calibration FAILED, sensor on calibrator?"
470      OUTPUT @Pwr_mtr;"SYST:ERR?"
480      ENTER @Pwr_mtr;Err_msg$                  ! Reading an error message clears it.
490      PRINT Err_msg$
500      PRINT Ques$
520    ELSE
521      IF Pass_cal<>0 THEN PRINT "Strange Response to CAL1?.  Clear output Queue?"
```

```
530   END IF
531   !
532   !
533   STOP
```

Program Output

```
Calibrating Sensor 1
-300,"Device-specific error;No Sensor"
Calibration FAILED, sensor on calibrator?
```

```
410  ASSIGN @Pwr_mtr to 70101
420  CLEAR @Pwr_mtr
440  WAIT 1
450   INPUT "Disconnect the sensor from the cable 1 second after hitting ENTER.  Hit ENTER.",Dmy
460   PRINT "Calibrating Sensor 1"
470    OUTPUT @Pwr_mtr;"CAL1?"
480    ENTER @Pwr_mtr;Pass_cal
490    IF Pass_cal=0 THEN PRINT "Calibration Passed"
500    IF Pass_cal=1 THEN
510      Ques$="Calibration FAILED, sensor on calibrator?"
520      OUTPUT @Pwr_mtr;"SYST:ERR?"
530      ENTER @Pwr_mtr;Err_msg$                    ! Reading an error message clears it.
540      PRINT Err_msg$
550      PRINT Ques$
560    ELSE
570      IF Pass_cal<>0 THEN PRINT "Strange Response to CAL1?.  Clear output Queue?"
580    END IF
590    !
600    !
610    STOP
```

Program Output

```
Calibrating Sensor 1
-300,"Device-specific error;Sensor not connected to calibrator"
Calibration FAILED, sensor on calibrator?
```

```
410  ASSIGN @Pwr_mtr to 70101
420  CLEAR @Pwr_mtr
440  WAIT 1
450   INPUT "Do not connect the sensor to the calibrator.  Hit ENTER.",Dmy
460   PRINT "Calibrating Sensor 1"
470    OUTPUT @Pwr_mtr;"CAL1?"
480    ENTER @Pwr_mtr;Pass_cal
490    IF Pass_cal=0 THEN PRINT "Calibration Passed"
500    IF Pass_cal=1 THEN
510      Ques$="Calibration FAILED, sensor on calibrator?"
520      OUTPUT @Pwr_mtr;"SYST:ERR?"
530      ENTER @Pwr_mtr;Err_msg$                    ! Reading an error message clears it.
540      PRINT Err_msg$
550      PRINT Ques$
560    ELSE
570      IF Pass_cal<>0 THEN PRINT "Strange Response to CAL1?.  Clear output Queue?"
580    END IF
590    !
600    !
610    STOP
```

Program Output

```
Calibrating Sensor 1
-300,"Device-specific error;Sensor not connected to calibrator"
Calibration FAILED, sensor on calibrator?
```

```
410  ASSIGN @Pwr_mtr to 70101
420  CLEAR @Pwr_mtr
440   WAIT 1
449   PRINT "Connect the sensor to the calibrator."
450   INPUT "Remove the sensor 10 seconds after hitting ENTER.  Hit ENTER.",Dmy
460   PRINT "Calibrating Sensor 1"
470    OUTPUT @Pwr_mtr;"CAL1?"
480    ENTER @Pwr_mtr;Pass_cal
490    IF Pass_cal=0 THEN PRINT "Calibration Passed"
500    IF Pass_cal=1 THEN
510      Ques$="Calibration FAILED, sensor on calibrator?"
520      OUTPUT @Pwr_mtr;"SYST:ERR?"
530      ENTER @Pwr_mtr;Err_msg$                    ! Reading an error message clears it.
540      PRINT Err_msg$
550      PRINT Ques$
560    ELSE
570      IF Pass_cal<>0 THEN PRINT "Strange Response to CAL1?.  Clear output Queue?"
580    END IF
590    !
600    !
610    STOP
```

Program Output

```
Calibrating Sensor 1
-300,"Device-specific error;Sensor calibration error"
Calibration FAILED, sensor on calibrator?
```

```
410  ASSIGN @Pwr-mtr to 70101
420  CLEAR @Pwr_mtr
430   WAIT 1
440   INPUT "Connect the sensor to a source set to about 0 dBm.  Hit ENTER.",Dmy
450   PRINT "Zeroing Sensor 1"
460    OUTPUT @Pwr_mtr;"CAL1:ZERO?"
470    ENTER @Pwr_mtr;Pass_zer
480    IF Pass_zer=0 THEN PRINT "Zeroing Passed"
490    IF Pass_zer=1 THEN
500      Ques$="Zeroing FAILED, Source turned off?"
510      OUTPUT @Pwr_mtr;"SYST:ERR?"
520      ENTER @Pwr_mtr;Err_msg$                    ! Reading an error message clears it.
530      PRINT Err_msg$
540      PRINT Ques$
550    ELSE
560      IF Pass_zer<>0 THEN PRINT "Strange Response to CAL1:ZERO?.  Clear output Queue?"
570    END IF
580    !
590    !
600    STOP
```

Program Output

```
Zeroing Sensor 1
-300,"Device-specific error;Sensor zeroing error"
Zeroing FAILED, Source turned off?
```

```
410  ASSIGN @Pwr_mtr to 70101
420  CLEAR @Pwr_mtr
430   WAIT 1
440   INPUT "Disconnect the sensor from the sensor cable.  Hit ENTER.",Dmy
450   PRINT "Zeroing Sensor 1"
460    OUTPUT @Pwr_mtr;"CAL1:ZERO?"
470    ENTER @Pwr_mtr;Pass_zer
480    IF Pass_zer=0 THEN PRINT "Zeroing Passed"
490    IF Pass_zer=1 THEN
500      Ques$="Zeroing FAILED, Source turned off?"
510      OUTPUT @Pwr_mtr;"SYST:ERR?"
520      ENTER @Pwr_mtr;Err_msg$                          ! Reading an error message clears it.
530      PRINT Err_msg$
540      PRINT Ques$
550    ELSE
560      IF Pass_zer<>0 THEN PRINT "Strange Response to CAL1:ZERO?.  Clear output Queue?"
570    END IF
580    !
590    !
600    STOP
```

Program Output

```
Zeroing Sensor 1
-300,"Device-specific error;No Sensor"
Zeroing FAILED, Source turned off?
```

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Reading Power Measurements

FETCh?
MEASure?
READ?
*OPC

These commands are used to return measurement data from the 58542. During NORMal Mode the data will be single measurement values. During SWIFt or BURSt Modes, the data will be an array of values. Generally, it is a single array if one sensor is connected and calibrated and a dual array if two sensors are connected and calibrated.

FETC?

FETCh<channel 1 or 2>?

```
OUTPUT @Pwr_Mtr;"FETC1?"        ! Read previously triggered channel 1 power
                                ! Normal, Swift, or Burst mode data.
```

Response will be whatever is in the output buffer whether it is a new measurement or an old one.

DESCRIPTION

The FETCh? query command returns postprocessed measurement data from the active channels of the 58542. After receiving FETCh? the 58542 will output the contents of it's active data output buffer. The data size and output format of the buffer is dependent upon channel and measurement mode configuration.

For example, if channel 1 is defined as sensor 1 and channel 2 is defined as sensor 2/1, the FETCh? query command will return the power level incident upon sensor 1 and the ratio of the power levels incident upon sensors 2 and 1. FETCh? is used with NORMal mode measurements when INITiate:IMMediate is active, and for reading SWIFt and BURSt Mode measurement data from the 58542's data buffer.

MEAS?

MEASure<channel 1 or 2>[:SCALar:POWer]?

```
OUTPUT @Pwr_Mtr;"MEAS2?"        ! Arm, Trigger, and Measure Channel 2
                                ! power in NORMal mode.
```

Response is a power measurement.

DESCRIPTION

The MEAS? command returns measured data from the active software calculation channels of the 58542. The MEAS? command will also initiate the trigger cycle and will turn on the Auto Averaging mode; that is, measurement will be triggered and the data will be transmitted from the 58542 VXI Power Meter. This is in contrast to the FETCh? command which is capable of causing immediate output of the measurement data, but not initiating the triggering cycle.

READ?

READ<channel 1 or 2>[:POWer]?

OUTPUT @Pwr_Mtr;"READ2?" ! Trigger measurement and read Channel 2

Response is a power measurement.

DESCRIPTION

The READ[:POWer]? query command triggers measurement and sends the data to the controller. Sending the READ? command will enable the 58542 VXI Power Meter to acquire data at the next instrument trigger and return post-processed measurement data from the active channels of the 58542. READ uses the current sensor averaging setup.

*OPC

OUTPUT @Pwr_mtr;"*OPC" ! *OPC allows one time srq enable

DESCRIPTION

The *OPC command is used to determine when an operation is completed. This command is generally used to monitor the completion of long measurement sequences. It sets the operation complete bit in the event status register upon completion of operation.

OUTPUT @Pwr_mtr;"*OPC?" ! send a "1" upon operation complete

Response to this one time operation complete query is a "0" or a "1".

DESCRIPTION

Query responds by sending a "1" or a "0", respectively, to indicate operation complete or not complete.

EXAMPLE PROGRAMS

Organization of Examples

The purpose of this section is to give you a "quick start" in performing measurements. Therefore, the easiest measurement commands are in the first example, MEAS#? in NORMal Mode. This may not be the optimum 58542 configuration for your application. There are three example groups, NORMal Mode, SWIFt Mode, and BURSt Mode. The use of the three 58542 measurement data commands, MEAS#?, READ#?, and FETCh#? are explained in detail under the NORMal Mode which is the 58542s' power-on default mode.

SWIFt and BURSt Mode measurements use only FETCh#?, not READ#? or MEAS#?. In this getting started section, high speed SWIFt and BURSt Mode examples are few in number and brief in description; detailed information on high speed power measurements can be found in the section titled High Speed Measurements on page 3-69.

NORMal Mode

The following program configures the power meter for single channel operation, and uses the MEAS#? command to perform limited Auto-Configuration and return power measurement data in NORMal Mode. Prior to executing the measurement cycle, the MEAS#? command performs low level configuration functions for averaging and trigger sequence arming automatically. Use MEAS#? to get started performing power measurements quickly. Typically, MEAS#? will satisfy most of your power measurement needs; however, more advanced power meter users of NORMal Mode may prefer lower level controls of the READ#? command and the higher measurement rates of the FETCh#? command. High speed measurements are performed using the SWIFt and BURSt Modes, not NORMal Mode.

Note that the MEAS#? command's measurement response speed is slower at very low power levels and faster at high power levels. This is due to a chopper stabilization system used in the NORMal Mode (also used in SWIFt Mode, but not BURSt mode) and Auto-Averaging when using SENS#:AVER:TCON REP. At the most sensitive gain ranges, chopper stabilization allows the very small voltages from the power sensor to be accurately measured. Also, at lower power meter gain ranges, Auto-Averaging automatically adds additional averaging to counter the effects of noise in the measurement signal. The extra time required to perform these Auto-Averaged measurements will not be apparent unless you switch the default averaging control, SENS#:AVER:TCON MOV, to SENS#: AVER:TCON REP.

When you use the MEAS#? command, Auto-Averaging is automatically set to ON. If another part of your programming was using manual averaging, be sure to turn Auto-Averaging back off ("SENS#:AVER:COUN:AUTO OFF") before you exit the section of your program code using MEAS? When operating in NORMal Mode you can always use the SENS#:AVER:COUN? query to find out the current averaging value for a particular sensor, and the SENS#:AVER:COUN ### command to set a higher or lower averaging value.

```
260  ASSIGN @Pwr_mtr to 70101
270  CLEAR @Pwr_mtr
280   WAIT 1
290  OUTPUT @Pwr_mtr;"CALC1:MODE NORM"      ! Can ONLY send Configuration Commands in Normal Mode!!
300  OUTPUT @Pwr_mtr;"CALC1:POW 1"          ! Channel 1 configured to measure sensor 1 power
310  !
320  OUTPUT @Pwr_mtr;"SENS1:CORR:FREQ 1.44E9"  ! Applies Cal Factor for 1.44 GHz to measurement data.
330  !
340  FOR I=1 TO 10
350    OUTPUT @Pwr_mtr;"MEAS1?"             ! Measures Power at sensor.
360    ENTER @Pwr_mtr;Rdg
370    PRINT Rdg
380  NEXT I
390  !
510  END
```

If you send the MEAS#? command, two configuration changes occur. These are listed in Table 3-B on the next page. If you prefer to perform measurements without changing the configuration, use the READ#? command.

Table 3-B. MEAS#? Command Automatic Configuration Changes

Command/Configuration Item	"MEAS?" Auto-Setting
a. SENS#:AVER:COUN:AUTO	ON
b. INIT:CONT	OFF

No other items than the above will change configuration when you send the "MEAS#?" command.

The following example illustrates that Auto-Averaging changes the active averaging number. Since Auto-Averaging was activated through use of the MEAS#? command, the averaging value currently in use when Auto-Averaging is set to OFF is taken as the new averaging number. This is likely to differ from the averaging number in effect before the MEAS#? command was sent. If this is an undesirable effect, remember to read the averaging number using "SENS#:AVER:COUN?" and store the value for post Auto-Averaging output at the conclusion of the "MEAS#?" power meter reading measurement routine.

```
260  ASSIGN @Pwr_mtr to 70101
270  CLEAR @Pwr_mtr
290  WAIT 1
300  OUTPUT @Pwr_mtr;"CALC1:MODE NORM"
310  OUTPUT @Pwr_mtr;"SENS1:AVER:COUN:AUTO OFF"
320  OUTPUT @Pwr_mtr;"SENS1:AVER:COUN:AUTO?"
330  ENTER @Pwr_mtr;A$
340  PRINT A$,"1 is AUTO ON"
350  OUTPUT @Pwr_mtr;"SENS1:AVER:COUN 16"
360  OUTPUT @Pwr_mtr;"SENS1:AVER:COUN?"
370  ENTER @Pwr_mtr;A$
380  PRINT A$,"16 MEANS AVERAGING #=16 ACCEPTED."
390  OUTPUT @Pwr_mtr;"INIT:CONT ON"
400  OUTPUT @Pwr_mtr;"INIT:CONT?"
410  ENTER @Pwr_mtr;A$
420  PRINT A$,"1 is INIT:CONT ON"
430  OUTPUT @Pwr_mtr;"CALC1:POW 1"          ! Channel 1 configured to measure sensor 1 power
440  !
450  OUTPUT @Pwr_mtr;"SENS1:CORR:FREQ 1.44E9"   ! Applies Cal Factor for 1.44 GHz.
460  !
470  FOR I=1 TO 10
480    OUTPUT @Pwr_mtr;"MEAS1?"                 ! Measures Power at sensor.
490    ENTER @Pwr_mtr;Rdg
500    PRINT Rdg
510  NEXT I
520  !
530  OUTPUT @Pwr_mtr;"SENS1:AVER:COUN:AUTO?"
540  ENTER @Pwr_mtr;A$
550  PRINT A$,"1 is AUTO ON"
560  OUTPUT @Pwr_mtr;"INIT:CONT?"
570  ENTER @Pwr_mtr;A$
580  PRINT A$,"1 is INIT:CONT ON"
590  OUTPUT @Pwr_mtr;"SENS1:AVER:COUN:AUTO OFF"
600  OUTPUT @Pwr_mtr;"SENS1:AVER:COUN:AUTO?"
```

```
610  ENTER @Pwr_mtr;A$
620  PRINT A$,"1 is AUTO ON"
630  OUTPUT @Pwr_mtr;"SENS1:AVER:COUN?"
640  ENTER @Pwr_mtr;A$
650  PRINT A$,"Value not equal to 16 means reset by Auto-Averaging during MEAS#?"
760  !
770  END
```

The following program configures the power meter for dual channel operation and uses the MEAS#? command to return power measurement data in NORMal Mode. Please note that measurement speed per channel decreases slightly in NORMal mode when two channels, versus only a single channel, are connected and calibrated. In NORMal Mode, single channel measurement rates are slightly faster than two channel measurement rates. If you are using CW power sensors, also please note that power measurements are not performed at specifically the exact, simultaneous instant in time. In NORMal Mode there will be a short time delay of about 3 ms between the two channels' sample points, about two and a half orders of magnitude faster than traditional CW power meters. In BURSt and SWIFT mode this time is about 1 ms. If you need to guarantee that power sampling occurs on both channels within a smaller interval of time, this can be accomplished to within about 2% of the Sample Delay time plus 2 ns using the 80350A Series Peak Power Sensors and triggering both sensors at the same time. The example below operates with either Peak or CW power sensors.

```
260  ASSIGN @Pwr_mtr to 70101
270  CLEAR @Pwr_mtr
280  WAIT 1
290  OUTPUT @Pwr_mtr;"CALC1:MODE NORM"        ! Can ONLY send Configuration Commands in Normal
                                              ! Mode!!
300  OUTPUT @Pwr_mtr;"CALC1:POW 1"            ! Channel 1 configured to measure sensor 1 power
310  OUTPUT @Pwr_mtr;"CALC1:UNIT W"           ! Transmitter output power in Watts.
320  OUTPUT @Pwr_mtr;"CALC2:RAT 1,2"          ! Transmitter gain stays in default, dBm.
330  !
340  OUTPUT @Pwr_mtr;"SENS1:CORR:FREQ 1.44E9" ! Applies Cal Factor for 1.44 GHz to sensor 1 data.
350  OUTPUT @Pwr_mtr;"SENS2:CORR:FREQ 0.96E9" ! Applies Cal Factor for 960 MHz to sensor 2 data.
360  !
370  FOR I=1 TO 10
380    OUTPUT @Pwr_mtr;"MEAS1?;MEAS2?"        ! Measures Power at sensors.
390    ENTER @Pwr_mtr;Chn_pow1
400    ENTER @Pwr_mtr;Chn_1rat2
410    PRINT Chn_pow1,Chn_1rat2
420  NEXT I
430  !
550  END
```

The following program configures the power meter for single channel operation and uses the READ#? command to return power measurement data in NORMal Mode. Using the READ#? command will not change power meter configuration items under any circumstances. Note that INIT:CONT ON is illegal when using READ#?. When continuous trigger arming is desired, use INIT:CONT ON with the FETCh#? command if desired. Also, use TRIG:SOUR IMM when using the READ#? command.

```
280  ASSIGN @Pwr_mtr to 70101
290  CLEAR @Pwr_mtr
300  WAIT 1
310  OUTPUT @Pwr_mtr;"CALC1:MODE NORM"        ! Can ONLY send Configuration Commands in Normal
                                              ! Mode!!
320  OUTPUT @Pwr_mtr;"TRIG:SOUR IMM"          ! TRIG:SOUR must be IMM when using READ#?
330  OUTPUT @Pwr_mtr;"INIT:CONT OFF"          ! INIT:CONT arming must be OFF when using READ#?
340  !
350  OUTPUT @Pwr_mtr;"SENS2:AVER:COUN 1"      ! Sets averaging to manual and one sample per reading.
360  OUTPUT @Pwr_mtr;"CALC1:POW 2"            ! Channel 1 configured to measure sensor 2 power
370  !
380  OUTPUT @Pwr_mtr;"SENS2:CORR:FREQ 17.4E9" ! Applies Cal Factor for 17.4 GHz to measurement data.
390  !
400  FOR I=1 TO 10
410   OUTPUT @Pwr_mtr;"READ2?"                ! Measures Power at sensor.
420   ENTER @Pwr_mtr;Rdg
430   PRINT Rdg
440  NEXT I
450  !
650  END
```

Note that READ#? measurement response speed is slower at very low power levels and faster at high power levels. This is due to a chopper stabilization system used in the NORMal Mode which is also used in the SWIFt Mode, but not the BURSt mode. At the most sensitive gain ranges, chopper stabilization allows the very small voltages from the power sensor to be accurately measured.

The following program configures the power meter for dual channel operation and uses the READ#? command to return power measurement data in NORMal Mode.

```
260  ASSIGN @Pwr_mtr to 70101
270  CLEAR @Pwr_mtr
280  WAIT 1
290  OUTPUT @Pwr_mtr;"CALC1:MODE NORM"        ! Can ONLY send Configuration Commands in Normal
                                              ! Mode!!
300  OUTPUT @Pwr_mtr;"CALC1:POW 1"            ! Channel 1 configured to measure sensor 1 power
310  OUTPUT @Pwr_mtr;"CALC1:UNIT W"           ! Transmitter output power in Watts.
320  OUTPUT @Pwr_mtr;"CALC2:RAT 1,2"          ! Transmitter gain stays in default, dBm.
330  !
340  OUTPUT @Pwr_mtr;"TRIG:SOUR IMM"          ! TRIG:SOUR must be IMM when using READ#?
350  OUTPUT @Pwr_mtr;"INIT:CONT OFF"          ! INIT:CONT arming must be OFF when using READ#?
360  !
370  OUTPUT @Pwr_mtr;"SENS1:AVER:COUN 1"      ! Sets averaging to manual and one sample per reading.
380  OUTPUT @Pwr_mtr;"SENS2:AVER:COUN 16"     ! Sets averaging to manual and 16 samples per reading.
390  !
400  OUTPUT @Pwr_mtr;"SENS1:CORR:FREQ 1.44E9" ! Applies Cal Factor for 1.44 GHz to sensor 1 data.
410  OUTPUT @Pwr_mtr;"SENS2:CORR:FREQ 0.96E9" ! Applies Cal Factor for 960 MHz to sensor 2 data.
420  !
430  FOR I=1 TO 10
440   OUTPUT @Pwr_mtr;"READ1?;READ2?"         ! Measures Power at sensors.
450   ENTER @Pwr_mtr;Chn_pow1
460   ENTER @Pwr_mtr;Chn_1rat2
```

```
470   PRINT Chn_pow1,Chn_1rat2
480  NEXT I
490  !
610  END
```

FETCh? allows finer control of the 58542s' measurement sequences. The low level control function of FETCh#? is to first, process the measurement channel information based upon sensor data and configuration settings and then, place the result in the 58542s' data output buffer to be read by the slot 0 controller/resource manager.

The following program uses the INIT command to control acceptance of measurement values in conjunction with the FETCh? command. When using FETCh#?, both trigger sequence arming and triggering/data acquisition must be controlled in your program. This is juxtaposed with MEAS#? and READ#? which, being higher level commands, include these functions.

Please note that this program will allow the fastest measurement speed performance in NORMal mode.

```
280  ASSIGN @Pwr_mtr to 70101
290  CLEAR @Pwr_mtr
300  WAIT 1
310  OUTPUT @Pwr_mtr;"CALC1:MODE NORM"          ! Can ONLY send Configuration Commands in Normal
                                                ! Mode!!
320  OUTPUT @Pwr_mtr;"TRIG:SOUR IMM"            ! Power Meter controls triggering with TRIG or *TRG
330  OUTPUT @Pwr_mtr;"INIT:CONT ON"             ! Power Meter controls instrument trigger arming
340  !
350  OUTPUT @Pwr_mtr;"SENS2:AVER:COUN 1"        ! Sets averaging to manual and one sample per reading.
360  OUTPUT @Pwr_mtr;"CALC1:POW 2"              ! Channel 1 configured to measure sensor 2 power
370  !
380  OUTPUT @Pwr_mtr;"SENS2:CORR:FREQ 17.4E9"   ! Applies Cal Factor for 17.4 GHz to data.
390  !
400  FOR I=1 TO 10
430    OUTPUT @Pwr_mtr;"FETC1?"                 ! Measures Power at sensor.
440    ENTER @Pwr_mtr;Rdg
450    PRINT Rdg
460  NEXT I
470  !
670  END
```

The following example is similar to the example above; however, it now uses TRIG:SOUR BUS instead of IMMediate so that triggering is controlled by the TRIG command. EXT or TTLT triggering can not be used in NORMal Mode. Additionally, INIT:CONT is set to OFF, allowing the INIT (or INIT:IMM) command to control arming of the triggering cycle.

```
280  ASSIGN Pwr_mtr to 70101
290  CLEAR @Pwr_mtr
300  WAIT 1
310  OUTPUT @Pwr_mtr;"CALC1:MODE NORM"          ! Can ONLY send Configuration Commands in Normal
                                                ! Mode!!
320  OUTPUT @Pwr_mtr;"TRIG:SOUR BUS"            ! Program controls triggering with TRIG or *TRG
```

```
330 OUTPUT @Pwr_mtr;"INIT:CONT OFF"                ! Program controls instrument trigger arming
340 !
350 OUTPUT @Pwr_mtr;"SENS2:AVER:COUN 1"            ! Sets averaging to manual and one sample per reading.
360 OUTPUT @Pwr_mtr;"CALC1:POW 2"                  ! Channel 1 configured to measure sensor 2 power
370 !
380 OUTPUT @Pwr_mtr;"SENS2:CORR:FREQ 17.4E9"       ! Applies Cal Factor for 17.4 GHz to data.
390 !
400 FOR I=1 TO 10
410   OUTPUT @Pwr_mtr;"INIT"                       ! INIT arms the triggering and measurement cycle
420   OUTPUT @Pwr_mtr;"TRIG"                       ! BUS trigger
430   OUTPUT @Pwr_mtr;"FETC1?"                     ! Measures Power at sensor.
440   ENTER @Pwr_mtr;Rdg
450   PRINT Rdg
460 NEXT I
470 !
670 END
```

The following program shows fast BUS triggering in the SWIFt Mode. TRIG (or *TRG) is used to acquire data, and FETCh#? processes and outputs the data to the slot 0 controller/resource manager. This program does not use the 58542s' data buffering capability.

```
170 ASSIGN @Pwr_mtr to 70101
180 CLEAR @Pwr_mtr
190 WAIT 1
200 OUTPUT @Pwr_mtr;"*CLS"                         ! Clears old messages from SYST:ERR buffer
205 WAIT 0.3
210 PRINT "Running..."
220 !
230 OUTPUT @Pwr_mtr;"CALC1:MODE NORM"              ! NORMal Mode to perform channel configuration
240 OUTPUT @Pwr_mtr;"CALC1:POW 1"                  ! Channels 1 or 2 can be either POW 1 or POW 2
250                                                ! RAT and DIFF are illegal in SWIFt and BURSt
                                                   ! Modes.
260 !
270 !################################################
280 !
290 ! Entering SWIFt Mode
300 !
310 OUTPUT @Pwr_mtr;"CALC1:MODE SWIF"              ! Enters SWIFt Mode for fastest individual data point
                                                   ! triggered measurements.
320 !
330 OUTPUT @Pwr_mtr;"SENS1:CORR:FREQ 1.44E9"       ! Applies Cal Factor in SWIFt mode
340                                                ! Can be sent before or after CALC#:MODE SWIF
350 !
360 OUTPUT @Pwr_mtr;"TRIG:SOUR BUS"               ! BUS or EXT triggering is slower than IMM
370                                                ! Can be sent before or after CALC#:MODE SWIF
380 !
390 FOR I=1 TO 10
400   FOR K=1 TO 20
410     OUTPUT @Pwr_mtr;"TRIG"                     ! TRIG is the SCPI Bus trigger. Can also use *TRG
420     OUTPUT @Pwr_mtr;"FETC1?"                   ! FETC#? acquires data
430     ENTER @Pwr_mtr;Chan1sens_1(K)
440     !ENTER @Pwr_mtr;Chan1sens_1(K),Chan2sens_2(K)  ! Use this line when two sensors are attached.
450   NEXT K
460   !
```

```
470   PRINT Chan1sens_1(*)
480   !PRINT Chan1sens_1(*),Chan2sens_2(*)          ! Use this line when two sensors are attached.
490   PRINT ""
500  NEXT I
510  !
520  END
```

The following program uses BURSt Mode for the fastest measurement rates possible. The maximum measurement speed is performed when TRIG:DEL is set to 0. TRIG:DEL controls the speed of sampling and data buffering. When TRIG:DEL is set to 0.004, samples will be taken every 4 milliseconds, on both channels if connected, and stored in the 58542s' internal data buffer. This speed does not control or account for the 58542s' internal data processing time after data acquisition or the speed of data transfer to your controller. This second component of time, the time to get data from the 58542, is proportional to the number of data points measured. Therefore, the example below uses only one channel and keeps the number of points buffered to a minimum.

Both channels' data will be taken at the same time during BURSt Mode. Power meter measurement speed does not change when two sensors are connected versus only one sensor. However, the 58542s' processing time and the time to transmit the data over the VXI and GPIB interfaces takes longer due to the additional sensor data. If two sensors are connected, calibrated, and their respective channels are set to ON, then you must read both arrays of data. Only read one array of data when one sensor is attached, calibrated, and set to ON.

As shown in the examples, send the CALC#:MODE BURS command prior to sending the BURSt Mode configuration commands TRIG:SOUR, TRIG:MODE, TRIG:COUN, and TRIG:DEL.

```
10   ALPHA ON
20   CLEAR SCREEN
30   !
40   OPTION BASE 1
50   DIM Id$[50],Err_msg$[70]
60   DIM Ques$[200],A$[80],Chan1sens_1(500)
70   DIM Chan2sens_2(500)
80   !
90   !
100  !#################################################
110  !       Instrument ADDRESS ALLOCATION
120  !
130  ASSIGN @Slot0 TO 70100                    ! 70100 is Logical Address of the Slot 0 controller
140  ASSIGN @Pwr_mtr TO 70101                  ! 70101 is Power Meter in 1st position right of slot 0
150  !#################################################
160  !
170  ! Identify Attached Instruments
180  !
190  OUTPUT @Slot0;"*IDN?"
200  ENTER @Slot0;Id$
210  PRINT "SLOT 0 is ";Id$
220  !
230  OUTPUT @Pwr_mtr;"*IDN?"
240  ENTER @Pwr_mtr;Id$
```

```
250  PRINT "SLOT 1 is ";Id$
260  WAIT 1
270  !
280  !
290  CLEAR @Pwr_mtr
300  WAIT 1
310  OUTPUT @Pwr_mtr;"*CLS"                    ! Clears old messages from SYST:ERR buffer
320  WAIT 0.3
330  OUTPUT @Pwr_mtr;"CALC1:MODE NORM"         ! NORMal Mode to perform channel configuration
340  OUTPUT @Pwr_mtr;"CALC1:POW 1"             ! Channels 1 or 2 can be either POW 1 or POW 2
350                                            ! RAT and DIFF are illegal in SWIFt and BURSt
                                               ! Modes.
360  OUTPUT @Pwr_mtr;"TRIG:SOUR IMM"           ! IMM set here to highlight conflict with BURSt
                                               ! operation.
370  !
380  !#################################################
390  !
400  ! Entering BURSt Mode
410  !
420  OUTPUT @Pwr_mtr;"CALC1:MODE BURS"         ! Enters BURSt Mode for fastest measurement speeds.
430  !
440  OUTPUT @Pwr_mtr;"SENS1:CORR:FREQ 2.44E9"  ! Applies Cal Factor in BURSt mode
450                                            ! Can be sent before or after CALC#:MODE BURS
460  !
470  OUTPUT @Pwr_mtr;"TRIG:SOUR BUS"           ! IMM triggering is illegal in BURSt Mode, Use BUS or
                                               ! EXT.
480                                            ! Can be sent before or after CALC#:MODE BURS
490  !
500  OUTPUT @Pwr_mtr;"TRIG:MODE POST"          ! Data acquired after trigger, not before as with PRE.
510                                            ! Send only after CALC#:MODE BURS
520  !
530  OUTPUT @Pwr_mtr;"TRIG:COUN 500"           ! 500 readings acquired and stored with each trigger.
540                                            ! Send only after CALC#:MODE BURS, following
                                               ! TRIG:MODE.
550                                            ! Be sure COUN# matches ENTER variable dimension.
560  !REDIM Chan1sens_1(500),Chan2sens_2(500)  ! REDIM to smaller array size only if necessary.
570  !
580  OUTPUT @Pwr_mtr;"TRIG:DEL .000"           ! 0 millisecond between rdgs setting is 5100 rdgs/sec.
590                                            ! Send only after CALC#:MODE BURS, following
                                               ! TRIG:COUN.
600  !
610  !
620  FOR I=1 TO 10
630    Time1=TIMEDATE
640    !
650    OUTPUT @Pwr_mtr;"TRIG"                  ! TRIG is the SCPI Bus trigger. Can also use *TRG
660    OUTPUT @Pwr_mtr;"FETC1?"                ! FETC#? acquires data
670    ENTER @Pwr_mtr;Chan1sens_1(*)
680    !ENTER @Pwr_mtr;Chan1sens_1(*),Chan2sens_2(*)  ! Use this line when two sensors are attached.
690    !
700    Time2=TIMEDATE
710    Time=Time2-Time1
720    Speed=500/Time
```

```
730   PRINT Chan1sens_1(*)
740   !PRINT Chan1sens_1(*),Chan2sens_2(*)          ! Use this line when two sensors are attached.
750   PRINT Speed;" readings per second, round trip."
760   PRINT ""
770 NEXT I
780 !
790 END
```

Special Errors.

If you are are seeing an unusual or non-sense numeric response, such as "9e+40", it indicates that you are getting an error response. For instance, if you have not performed the power sweep calibration procedure to calibrate the sensor to the power meter, the response to a MEAS#? command will be "9.0000e+40".

Selected basic SCPI syntax and execution errors apply to these commands.

> If you are using the READ#? measurement query and INIT:CONT is ON, you will get a bad value returned, "9e+40". If you send SYST:ERR? errror query, "-213, Init ignored" will be returned. READ#? contains the low level function INIT, since INIT:CONT is ON the INIT within READ#? generates an error. Set INIT:CONT to OFF when using READ#?.

There are no device specific errors for the preset configuration or status reset commands except the high level -300,"Device-specific error." response.

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Instrument Triggering

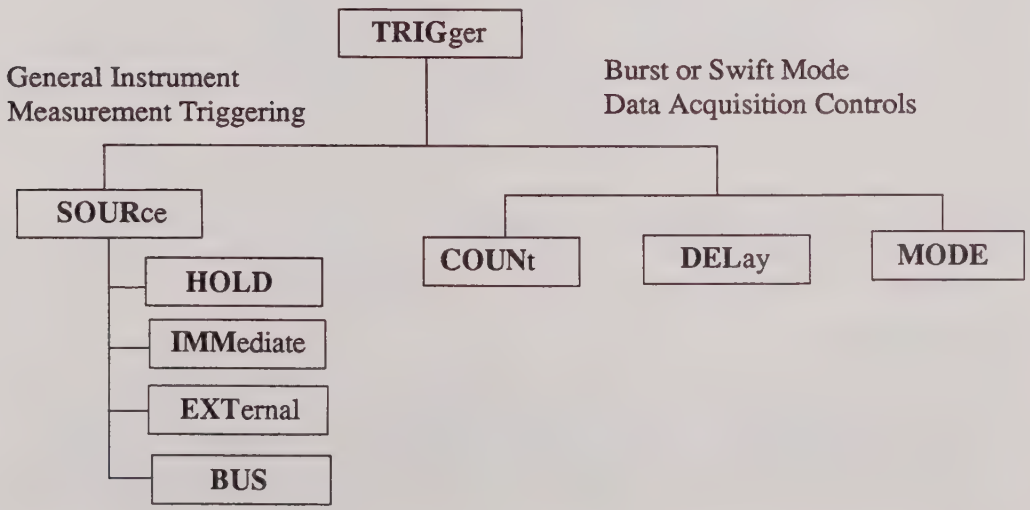
***TRG**
TRIGger[:IMMediate]
TRIGger:SOURce
TRIGger:MODE
TRIGger:DELay
TRIGger:COUNt
INITiate:CONTinuous
INITiate[:IMMediate]
***WAI**

The SCPI commands shown to the left are used to trigger the Giga-tronics 58542s' measurement cycle. These commands do not configure or provide triggering for Peak Power Sensors. Those commands are defined in the section on Peak Power Sensor Triggering on page 3-82.

For 58542 VXI Power Meter Operation, the TRIGger Subsystem is divided into two sections; Instrument Measurement Event Triggering, and Special Triggering Configuration commands for the fast reading buffered data modes, Burst Mode and Swift Mode.

The query form of these commands will return the instruments current configuration status. This can be used to verify triggering configuration or return current status information following command errors.

TRIGger Subsystem Command Tree



EXT triggering is performed with the front panel BNC connector and will only work in the BURSt and SWIFt Modes. EXT triggering is not available in the NORMal Mode. Provision has been made for a hardware "ready for new trigger" type handshaking capability using the analog output.

BUS triggering is available for all operating modes, BURSt, SWIFt, and NORMal.

IMMediate triggering allows the 58542 to free run and continuously perform measurements. This is the default setting. You may also want to INITiate on IMMediate to increase measurement speed. During Normal Mode, with both of these controls set to IMM, power measurements can be read with MEAS, READ, or FETCh. IMMediate triggering is not compatible with the BURSt Mode. If you send the CALC#:MODE BURS command to enter the BURSt Mode, IMM instrument triggering for NORMal Mode will automatically be switched to TRIG:SOUR BUS. If you send the CALC#: MODE SWIF command to enter the SWIFt Mode, IMM instrument triggering will remain IMM but a device specific error will be generated whenever you specify a TRIG:COUN# higher than 1.

*TRG

***TRG**

```
OUTPUT @Pwr_mtr;"*TRG"                    ! VXI BUS Trigger Event
```

DESCRIPTION

*TRG is an IEEE-488.2 compatible command which is used within programming to initiate BUS triggered measurements. The 58542 VXI Power Meter interprets *TRG as a BUS source for instrument triggering events. This command will not trigger Peak Power Sensors. It is the same as the TRIG command.

TRIG

TRIGger[:IMMediate]

```
OUTPUT@Pwr_mtr;"TRIG"                     ! Trigger measurement cycle
```

DESCRIPTION

TRIG is the SCPI command form of *TRG. The 58542 VXI Power Meter interprets TRIG as a BUS source for instrument triggering events. If INIT:CONT is OFF, measurements using FETCh#? will not proceed until triggering is armed and ***instrument*** triggering is actuated.

TRIG:SOUR

TRIGger:SOURce*space*<instrument triggering source IMMediate, BUS, HOLD, or EXTernal>

```
OUTPUT@Pwr_mtr;"TRIG:SOUR IMM"            ! Set instrument measurement trigger
                                          ! source to IMMediate
```

DESCRIPTION

TRIG:SOUR IMM sets trigger control to the 58542. BUS triggering sets the triggering control to your controller's software program using TRIG or *TRG commands. HOLD halts triggering sequences. EXTernal sets triggering control to the front panel BNC connector. The table at the top of the next page shows triggering and operating mode compatibility.

Operating Mode	IMM	BUS	HOLD	EXT
NORMal	X	X	X	
SWIFT	X	X		X
BURST		X		X

If the 58542 has been configured for EXT triggering in the BURSt or SWIFt modes and the operating mode is switched to NORMal, the triggering configuration remains EXT. However, if the configuration is IMM in NORMal mode and the 58542 is switched to BURSt, the 58542 automatically switches to BUS. As a general rule, when a measurement subroutine switches operating modes, you should re-send the triggering configuration.

TRIGger:SOURce?

```
OUTPUT @Pwr_mtr;"TRIG:SOUR?"          ! Set instrument measurement trigger
                                      ! source
```

Response is instrument triggering source" IMM", "BUS", "HOLD", or "EXT".

DESCRIPTION

This query responds with the current setting of the TRIG:SOUR command.

TRIG:MODE

TRIGger:MODE*space*<burst mode data gathering POST trigger receipt or PRE trigger receipt>

```
OUTPUT@Pwr_mtr;"TRIG:MODE POST"       ! Set Burst or Swift mode data collection
                                      ! relative to Timing of event trigger post
```

DESCRIPTION

This command is only for BURSt Mode measurements. Send this command only immediately after CALC#:MODE BURS. TRIG:MODE controls the operation of the FIFO data buffer inside the 58542. When set to POST, the burst of data points is taken after the receipt of a valid instrument trigger. When set to PRE, the burst of data is assumed to be those data points that have arrived immediately preceding the valid instrument trigger event. Using PRE requires some caution: the single processor inside the 58542 is performing data acquisition constantly. If you send any configuration commands while the 58542 is collecting the PRE trigger data, you may inadvertantly interrupt the timing of the data point collection.

TRIGger:MODE?

```
OUTPUT @Pwr_mtr;"TRIG:MODE?"          ! Query Burst or Swift mode returns
```

Response is "PRE" or "POST".

DESCRIPTION

This query command responds with the current setting of the BURSt mode pre or post triggered data collection. The query can be used in any operating mode.

TRIG:DEL

TRIGger:DELay*space*<delay time between buffered readings in sec, 0.000 to 5.000>

```
OUTPUT @Pwr_mtr;"TRIG:DEL 5e-3"        ! Set Burst mode measurement time to
                                       ! 5 ms between measurements.
OUTPUT @Pwr_mtr;"TRIG:DEL 0"           ! Max. measurement rate
                                           (resolution, one msec)
```

DESCRIPTION

This command applies only to the BURSt Mode. It sets the time interval between the measurements, and is accurate to about 5%. This is the only way to control the 58542's data acquisition of individual data points in a burst measurement. Burst measurement data is taken following, or just prior to, a single instrument trigger event. The number of measurements taken is controlled by TRIG:COUNt. Timing can be set in 0.001 second increments from 0.000 to 5.000 seconds, inclusive. Setting this control to 0.000 activates the highest reading rate possible with the 58542; 5100 readings per second.

Please remember that triggering of the Peak Power Sensor occurs independently from instrument triggering. Therefore, there is a moderate ability to control triggering at the Peak Power Sensors. Generally, if you require control of individual data point triggering, the SWIFt mode will provide the highest measurement rates, with or without srq or hardware handshaking.

TRIGger:DELay?

```
OUTPUT @Pwr_mtr;"TRIG:DEL?"            ! Query Burst mode measurement time
                                       ! returns delay value
```

Response is a single number indicating the number of seconds between readings. Resolution to 0.001.

DESCRIPTION

This query returns the current setting of the delay time interval between burst mode data points.

TRIG:COUN

TRIGger:COUNt*space*<number of data values to buffer in memory form 1 to 5000 for standard 58542s, from 1 to 128,000 on one channel with option 02 and 1 to 64000 for two channels with option 02>

```
OUTPUT@Pwr_mtr;"TRIG:COUN 100"         ! Set Burst or Swift mode buffer reading
                                       ! number to 100
```

DESCRIPTION

The 58542 has an internal - and expandable - data buffer for storing measurement data until the slot 0 controller/resource manager is ready to read the data. During the SWIFt or BURSt modes, this command controls the number of power readings that are stored in the 58542 data buffer.

The value specified here applies to each individual channel. That is, if two sensors are attached and calibrated, the 58542 will perform the specified measurement and buffering for both channels. In the example shown for this command, that would be 100 points per

channel. Option 02 adds additional memory for 128,000 data point buffering. When two sensors are attached and calibrated, the maximum is 64,000 readings per channel.

During BURSt mode, the COUNt # of readings will be taken with just one instrument trigger. During the SWIFt Mode however, you can control the triggering of individual data points. If you set triggering to EXT, the 58542 will perform one measurement each time a TTL level signal is detected by the 58542. Then the value is stored in the data buffer. This continues until the 58542 has received and processed a COUNt # of triggers and also read in a COUNt # of data points to the buffer.

TRIGger:COUNt?

```
OUTPUT@Pwr_mtr;"TRIG:COUN?"          ! Query BURSt or SWIFt mode buffer number
```

Response is a single number - the number of data points to be stored in memory during Burst or Swift modes.

DESCRIPTION

This query returns the current setting of the number of data points to collect in the 58542's internal data buffer during BURSt or SWIFt Mode.

***WAI**

```
OUTPUT @Pwr_mtr;"*WAI"               ! Wait, following command completion
```

DESCRIPTION

The *WAI command causes the 58542 VXI Power Meter to wait until all previous commands and queries are completed before continuing operation. It functions only when using the Normal mode of operation.

Arming the TRIGgering Cycle

INITiate:CONTinuous
INITiate[:IMMediate]

The INITiate commands enable the 58542 VXI Power Meter to acquire measurement data at the next instrument trigger. In the absence of an instrument signal, the 58542 is placed in the waiting-for-trigger-state. The default configuration is continuous initiation, INIT:CONT ON.

The INITiate[:IMMediate] causes the 58542 VXI Power Meter to exit the idle state and causes the trigger system to initiate and complete one full trigger cycle, returning to the idle state upon completion. For example, INITiate[:IMMediate] can be used with Giga-tronics' Peak Power Sensors to measure the power level of transient or one-shot pulsed microwave signals. After execution of the triggering sequence, send the FETCh? query command to return the measurement data from the 58542.

Triggering configuration is performed with the TRIGger Subsystem commands. When TRIGger:SOURce is IMMediate, the measurement will start as soon as INITiate is sent to the 58542 and executed (or INITiate:CONTinuous ON sent and executed).

INIT:CONT

INITiate:CONTinuous*space*<ON or OFF>

```
OUTPUT @Pwr_mtr;"INIT:CONT ON"          ! Continuous Triggering
```

DESCRIPTION

This is the control that allows user control of measurement cycle arming. When INIT:CONT is set to ON, measurement cycle arming occurs automatically. The default setting is OFF. When you need to take control of arming the triggering of the measurement cycle, set this control to OFF. Then use MEAS#? or INIT with READ#? to perform the measurement. Another legal measurement control option would be INIT with TRIG:IMM and FETC#?

When INITiate:CONTinuous is set to ON, the 58542 instrument triggering cycle resets continuously; that is, upon instrument triggering, data is constantly being acquired and updated. Upon completion of a trigger cycle, the 58542 will immediately enter the wait-for-trigger state rather than the idle state, as is the case with INITiate:CONT OFF

INITiate:CONTinuous?

```
OUTPUT @Pwr_mtr;"INIT:CONT?"          ! Query ON or OFF status.
```

Response is a "1" or "0", for ON or OFF, respectively.

DESCRIPTION

This query returns the current setting of the the measurement cycles' continuous initiation. This command will quickly identify if initiation is under the control of the 58542 VXI Power Meter or the slot 0 controller/resource manager.

INIT:IMM

INITiate[:IMMediate]

```
OUTPUT @Pwr_Mtr;"INIT"                ! Initiate instrument triggering cycle
```

DESCRIPTION

The INITiate[:IMMediate] command places the 58542 VXI Power Meter in the wait-for-trigger-state. When used with EXT (TTL levels) instrument triggering, this property is useful for measuring signals that are asynchronous with programming (BUS triggered) sequences. When INITiate:CONTinuous is set to OFF, INITiate:[IMMediate] is used to enable the 58542 instrument triggering cycle. Sending INITiate:[IMMediate] when INITiate:CONTinuous is set to ON will cause a command error, -213. The INITiate [:IMMediate] command is an event; no query form exists for this command.

This command enables the triggering cycle. Instrument triggering will not occur - even when you are sending BUS or EXT triggers to the 58542 - unless INIT has been enabled. Either this command or INIT:CONT ON is used to perform measurements with FETCh? and READ? Please note that MEAS? is a high level function which contains the INITiation enabling function. Arming occurs automatically when using the MEAS#? command to automatically INITiate, TRIGger and FETCh the measurement data. However, if you are instead using READ#? or FETCh#? to read data, this command can be used to arm the 58542 for triggering upon the occurrence of the next valid trigger.

EXAMPLE PROGRAMS

The following two programs illustrate the operation of TRIG:SOUR HOLD with the MEAS#? and FETCh#? measurement data queries. This first program shows TRIG:SOUR HOLD used with MEAS#?. Since MEAS#? is a high level command containing it's own trigger sequence arming, triggering, and measurement data acquisition functions, the program returns valid measurement data. The output from the SYST:ERR query is -0,"No error".

```
260  ASSIGN @Pwr_mtr to 70101
270  CLEAR @Pwr_mtr
275  WAIT 1
280  OUTPUT @Pwr_mtr;"*CLS"          ! Clears old messages from SYST:ERR buffer
290  WAIT 0.3
```

```
300  OUTPUT @Pwr_mtr;"CALC1:MODE NORM"          ! NORMal Mode.
310  OUTPUT @Pwr_mtr;"CALC1:POW 1"              ! Channel 1 configured to measure sensor 1 power
320  OUTPUT @Pwr_mtr;"SENS1:CORR:FREQ 1.44E9"   ! Applies Cal Factor for 1.44 GHz to data.
330  !
340  OUTPUT @Pwr_mtr;"TRIG:SOUR HOLD"           ! Halts triggering when used with FETCh#?
350  !
360  FOR I=1 TO 10
370   OUTPUT @Pwr_mtr;"MEAS1?"                  ! MEAS#? returns valid data with TRIG:SOUR set to
                                                ! HOLD.
380   ENTER @Pwr_mtr;Rdg
390   PRINT Rdg
400  NEXT I
410  !
420  OUTPUT @Pwr_mtr;"SYST:ERR?"                ! Query error buffer
430  ENTER @Pwr_mtr;A$
440  PRINT A$
530  END
```

When FETCh#? is used while TRIG:SOUR is HOLD, invalid data, 9.e+40, is returned and the SYST:ERR? query returns -230,"Data corrupt or stale".

```
260  ASSIGN @Pwr_mtr to 70101
270  CLEAR @Pwr_mtr
275  WAIT 1
280  OUTPUT @Pwr_mtr;"*CLS"                     ! Clears old messages from SYST:ERR buffer
290  WAIT 0.3
300  OUTPUT @Pwr_mtr;"CALC1:MODE NORM"          ! NORMal Mode.
310  OUTPUT @Pwr_mtr;"CALC1:POW 1"              ! Channel 1 configured to measure sensor 1 power
320  OUTPUT @Pwr_mtr;"SENS1:CORR:FREQ 1.44E9"   ! Applies Cal Factor for 1.44 GHz to data.
330  !
340  OUTPUT @Pwr_mtr;"TRIG:SOUR HOLD"           ! Halts triggering when used with FETCh#?
350  !
360  FOR I=1 TO 10
370   OUTPUT @Pwr_mtr;"FETC1?"                  ! FETC#? will not acquire valid data when TRIG:SOUR
                                                ! is set to HOLD.
380   ENTER @Pwr_mtr;Rdg
390   PRINT Rdg
400  NEXT I
410  !
420  OUTPUT @Pwr_mtr;"SYST:ERR?"                ! Query error buffer
430  ENTER @Pwr_mtr;A$
440  PRINT A$
530  END
```

Please note, the READ#? measurement data query requires TRIG:SOUR IMM for proper operation. While TRIG:SOUR is HOLD, data output is also invalid, 9.e+40, but the SYST:ERR? query response is different, -214,"Trigger deadlock" .

```
260  ASSIGN @Pwr_mtr to 70101
270  CLEAR @Pwr_mtr
275  WAIT 1
280  OUTPUT @Pwr_mtr;"*CLS"                     ! Clears old messages from SYST:ERR buffer
290  WAIT 0.3
```

```
300  OUTPUT @Pwr_mtr;"CALC1:MODE NORM"          ! NORMal Mode.
310  OUTPUT @Pwr_mtr;"CALC1:POW 1"              ! Channel 1 configured to measure sensor 1 power
320  OUTPUT @Pwr_mtr;"SENS1:CORR:FREQ 1.44E9"   ! Applies Cal Factor for 1.44 GHz to data.
330  !
340  OUTPUT @Pwr_mtr;"TRIG:SOUR HOLD"           ! Halts triggering when used with FETCh#?
350  !
360  FOR I=1 TO 10
370   OUTPUT @Pwr_mtr;"READ1?"                  ! READ#? requires TRIG:SOUR IMM not, HOLD.
380   ENTER @Pwr_mtr;Rdg
390   PRINT Rdg
400  NEXT I
410  !
420  OUTPUT @Pwr_mtr;"SYST:ERR?"                ! Query error buffer
430  ENTER @Pwr_mtr;A$
440  PRINT A$
530  END
```

The following examples show the use of BUS triggering with FETCh#? in NORMal and BURSt Modes.

```
270  ASSIGN @Pwr_mtr to 70101
280  CLEAR @Pwr_mtr
290  WAIT 1
300  OUTPUT @Pwr_mtr;"CALC1:MODE NORM"          ! NORMal Mode.
310  OUTPUT @Pwr_mtr;"CALC1:POW 1"              ! Channel 1 configured to measure sensor 1 power
320  OUTPUT @Pwr_mtr;"SENS1:CORR:FREQ 1.44E9"   ! Applies Cal Factor for 1.44 GHz to data.
330  !
340  OUTPUT @Pwr_mtr;"TRIG:SOUR BUS"
350  !
360  FOR I=1 TO 10
362   OUTPUT @Pwr_mtr;"TRIG"                    ! TRIG is the SCPI Bus trigger. Can also use *TRG
370   OUTPUT @Pwr_mtr;"FETC1?"                  ! FETC#? acquires data
380   ENTER @Pwr_mtr;Rdg
390   PRINT Rdg
400  NEXT I
410  !
530  END
```

BURSt Mode BUS triggering with FETCh?

```
10   ALPHA ON
20   CLEAR SCREEN
30   !
40   OPTION BASE 1
50   DIM Id$[50],Err_msg$[70]
60   DIM Ques$[200],A$[80],Chan1sens_1(50)
70   DIM Chan2sens_2(50)
80   !
90   !
100  !#####################################################
110  !       Instrument ADDRESS ALLOCATION
120  !
130   ASSIGN @Slot0 TO 70100                   ! 70100 is Logical Address of the Slot 0 controller
```

```
140  ASSIGN @Pwr_mtr TO 70101                ! 70101 is Power Meter, in 1st position right of slot 0
150  !################################################
160  !
170  ! Identify Attached Instruments
180  !
190  OUTPUT @Slot0;"*IDN?"
200  ENTER @Slot0;Id$
210  PRINT "SLOT 0 is ";Id$
220  !
230  OUTPUT @Pwr_mtr;"*IDN?"
240  ENTER @Pwr_mtr;Id$
250  PRINT "SLOT 1 is ";Id$
260  WAIT 1
270  !
280  !
290  CLEAR @Pwr_mtr
300  WAIT 1
310  OUTPUT @Pwr_mtr;"*CLS"                  ! Clears old messages from SYST:ERR buffer
320  !
330  OUTPUT @Pwr_mtr;"CALC1:MODE NORM"       ! NORMal Mode to perform channel configuration
340  OUTPUT @Pwr_mtr;"CALC1:POW 1"           ! Channels 1 or 2 can be either POW 1 or POW 2
350                                          ! RAT and DIFF are illegal in SWIFt and BURSt Modes
360  OUTPUT @Pwr_mtr;"TRIG:SOUR IMM"         ! IMM set here to highlight conflict with BURSt operation
370  !
380  !################################################
390  !
400  ! Entering BURSt Mode
410  !
420  OUTPUT @Pwr_mtr;"CALC1:MODE BURS"       ! Enters BURSt Mode for fastest measurement speeds
430  !
440  OUTPUT @Pwr_mtr;"SENS1:CORR:FREQ 2.44E9"  ! Applies Cal Factor in burst mode
450                                          ! Can be sent before or after CALC#:MODE BURS
460  !
470  OUTPUT @Pwr_mtr;"TRIG:SOUR BUS"         ! IMM triggering is illegal in BURSt Mode, Use BUS or
                                             ! EXT.
480                                          ! Can be sent before or after CALC#:MODE BURS
490  !
500  OUTPUT @Pwr_mtr;"TRIG:MODE POST"        ! Data acquired after trigger, not before as with PRE.
510                                          ! Send only after CALC#:MODE BURS
520  !
530  OUTPUT @Pwr_mtr;"TRIG:COUN 50"          ! 50 readings acquired and stored with each trigger
540                                          ! Send only after CALC#:MODE BURS
550                                          ! Be sure COUN# matches ENTER variable dimension.
560 !REDIM Chan1sens_1(50),Chan2sens_2(50)   ! REDIM to smaller array size only if necessary
570  !
580  OUTPUT @Pwr_mtr;"TRIG:DEL .001"         ! 1 millisecond between rdgs, 0 ms is 5100 rdgs/sec
590                                          ! Send only after CALC#:MODE BURS
600  !
610  !
620  FOR I=1 TO 10
630  WAIT .01                                ! For handshaking compensation.  If necessary, use wait
640
650
660   OUTPUT @Pwr_mtr;"TRIG"                 ! TRIG is the SCPI Bus trigger. Can also use *TRG
```

```
670  WAIT .01                                          ! For handshaking compensation.  If necessary, use wait
680   OUTPUT @Pwr_mtr;"FETC1?"                         ! FETC#? acquires data
690   ENTER @Pwr_mtr;Chan1sens_1(*)
700  !ENTER @Pwr_mtr;Chan1sens_1(*),Chan2sens_2(*)     ! Use this line when two sensors are attached.
710   PRINT Chan1sens_1(*)
720  !PRINT Chan1sens_1(*),Chan2sens_2(*)              ! Use this line when two sensors are attached.
730   PRINT ""
740  NEXT I
750  !
760  END
```

Be careful when you use BURSt Mode. For example, you must use INIT:CONT ON; you don't have manual control of trigger sequence arming using INIT, as you do using the FETCh#? command with the NORMal Mode. This is of particular concern using TTL level triggering on either the front panel EXT connector or the VXI backplane TTLT trigger functions. You must control the triggering through control of the trigger source. That is, you must use INIT:CONT ON in BURSt Mode; you can't use INIT control arming of the trigger sequence.

The following example uses EXTernal TTL level triggering using the external trigger input on the front panel of the 58542 VXI Universal Power Meter. Twenty readings are stored in the measurement buffer. Then FETCh#? is used during SWIFt Mode. Please note there is a TTL level hardware handshake capability using the ANALOG OUT BNC connector which is also on the front panel. The Analog BNC will output a high (5V) when the instrument is ready for triggering. After a trigger is received, the Analog BNC output goes low (0V).

TRIG:SOUR HOLD can be used to halt the SWIFt Mode triggering sequence.

```
10   ALPHA ON
20   CLEAR SCREEN
30   !
40   OPTION BASE 1
50   DIM Id$[50],Err_msg$[70]
60   DIM Ques$[200],A$[80],Chan1sens_1(20)
70   DIM Chan2sens_2(20)
80   !
90   !
100  !#################################################
110  !       Instrument ADDRESS ALLOCATION
120  !
130  ASSIGN @Slot0 TO 70100                            ! 70100 is Logical Address of the Slot 0 controller
140  ASSIGN @Pwr_mtr TO 70101                          ! 70101 is Power Meter, in 1st position right of slot 0
150  !#################################################
160  !
170  !
180  CLEAR @Pwr_mtr
190  WAIT 1
200  OUTPUT @Pwr_mtr;"*CLS"                            ! Clears old messages from SYST:ERR buffer
210  WAIT 0.3
220  OUTPUT @Pwr_mtr;"CALC1:MODE NORM"                 ! NORMal Mode to perform channel configuration
230  OUTPUT @Pwr_mtr;"CALC1:POW 1"                     ! Channels 1 or 2 can be either POW 1 or POW 2
```

```
240                                                 ! RATio and DIFFerence configurations are illegal in
                                                    ! SWIFt and BURSt Modes.
250 !
260 !################################################
270 !
280 ! Entering SWIFt Mode
290 !
300 OUTPUT @Pwr_mtr;"CALC1:MODE SWIF"               ! Enters SWIFt Mode for fastest individual data point
                                                    ! triggered measurements.
310 !
320 OUTPUT @Pwr_mtr;"SENS1:CORR:FREQ 2.22E8"        ! Applies Cal Factor in SWIFt mode
330                                                 ! Can be sent before or after CALC#:MODE SWIF
340 !
350 OUTPUT @Pwr_mtr;"TRIG:SOUR EXT"                ! TTL level triggering, Each trigger acquires one data
                                                    ! point in SWIFt Mode.
360                                                 ! Can be sent before or after CALC#:MODE SWIF
370 !
380 OUTPUT @Pwr_mtr;"TRIG:COUN 20"                 ! Stores 20 points for simultaneous output using
                                                    ! FETCh#?.
390                                                 ! Must be sent after CALC#:MODE SWIF
400 !
410 !
420 FOR I=1 TO 10
430 !WAIT 2                                         ! If necessary, use wait
440
450  OUTPUT @Pwr_mtr;"FETC1?"                       ! FETC#? acquires data
460  ENTER @Pwr_mtr;Chan1sens_1(*)
470 !ENTER @Pwr_mtr;Chan1sens_1(*),Chan2sens_2(*)   ! Use this line when two sensors are attached.
480  !
490  PRINT Chan1sens_1(*)
500 !PRINT Chan1sens_1(*),Chan2sens_2(*)            ! Use this line when two sensors are attached.
510  PRINT ""
520 NEXT I
530 !
540 END
```

The fastest SWIFt Mode measurement speeds are achieved with TRIG:SOUR:IMM and TRIG:COUN set to values larger than about 25. See the High Speed Measurements section on page 3-69 for additional information and examples.

The fastest BURSt Mode measurement speeds are achieved with TRIG:COUN at about 80 and TRIG:DEL 0. See the High Speed Measurements section on page 3-69 for additional information and examples.

Channel Configuration

CALCulate:POWer
CALCulate:RATio
CALCulate:DIFFerence
CALCulate?
CALCulate:UNIT
CALCulate:STATE

CALC#:POW

CALCulate<channel 1 or 2>[:CHANnel]:POWer*space*<sensor 1 or 2>

```
OUTPUT @Pwr_Mtr;"CALC2:POW 1"          ! Configures channel 2 to
                                       ! measure Sensor 1 power
```

DESCRIPTION

This command configures an individual sensor to an individual channel; the channel measures the sensor power level. This command does not have a query format. For the above example, the response to a CALC2? query is "POW 1". This command should only be executed after the designated sensor has been calibrated.

CALC#:RAT

CALCulate<channel 1 or 2>[:CHANnel]:RATio*space*<sensor 1 or 2*comma*sensor 2 or 1>

```
OUTPUT @Pwr_Mtr;"CALC1:RAT 2,1"        ! Configures channel 1 to measure
                                       ! Sensor 2 over Sensor 1 power
```

DESCRIPTION

This command configures a channel to be a ratio of the power levels present at the two sensors. When UNITs are dBm, RATio configuration produces measurements in dB. When UNITS are W, RATio configuration measurements are in percent, %. This command does not have a query format. For the above example, the response to a CALC1? query is "RAT 2,1". This command should only be executed after the designated sensor has been calibrated.

CALC#:DIFF

CALCulate<channel 1 or 2>[:CHANnel]:DIFFerence*space*<sensor 1 or 2*comma*sensor 2 or 1>

```
OUTPUT @Pwr_Mtr;"CALC1:DIFF 2,1"       ! Configures channel 1 to measure
                                       ! Sensor 2 minus Sensor 1 power
```

DESCRIPTION

This command configures a channel to be the difference between the power levels present at the two sensors. UNITs are dBm or W. This command does not have a query format. For the above example, the response to a CALC1? query is "DIFF 2,1". This command should only be executed after the designated sensor has been calibrated.

CALC#?

CALCulate<channel 1 or 2>[:FUNCtion]?

OUTPUT@Pwr_mtr;"CALC2?" ! Query channel 2 sensor Configuration

Response is "POW #", RAT #,#", or "DIFF #,#"

DESCRIPTION

This command returns the current channel configuration. This command is a query format only.

CALC#:UNIT

CALCulate<channel 1 or 2>:UNIT[:POWer]*space*<data units selection, DBM or Watt>

OUTPUT @Pwr_Mtr;"CALC1:UNIT W" ! Selects channel 1 Linear Units, Watts

OUTPUT @Pwr_Mtr;"CALC1:UNIT DBM" ! Selects channel 1 Log Units, dBm

DESCRIPTION

This command configures a channel to report power measurements in either linear, W, units or logarithmic, dBm, units. When UNITs are dBm, the RATio configuration produces measurements in dB and POWer and DIFF measurements in dBm. When UNITS are W, the RATio configuration measurements are in percent, %, and POWer and DIFF measurements are in W.

CALCulate<channel 1 or 2>:UNIT[:POWer]?

OUTPUT @Pwr_Mtr;"CALC1:UNIT?" ! Query channel 1 Units Configuration

Response is "DBM", or "W".

DESCRIPTION

This command is the query format of the command above.

CALC#:STAT

CALCulate<channel 1 or 2>:STATe*space*<ON or OFF>

OUTPUT@Pwr_mtr;"CALC1:STAT OFF" ! Disable channel 1 measurement

DESCRIPTION

This command will turn a channel off or on. Default is "on". During Normal Mode and Swift Mode, measurement speed increases when only one sensor (Channel configuration is CALC#:POW) is performing measurements.

CALCulate<channel 1 or 2>:STATe?

OUTPUT@Pwr_mtr;"CALC1:STAT?" ! Query channel 1 measurement status

Response is "0" = off; "1" = on)

DESCRIPTION

This command is the query format of the command above.

Channel Configuration Program Examples

Single Sensor Power Measurement

Default definition of software calculation channels 1 and 2 are for sensors 1 and 2, respectively. This configuration allows measurement of the power level incident upon sensor 1 on software configuration channel 1, and measurement of the power level incident upon sensor 2 on software configuration channel 2. Normal Mode and Swift Mode measurements are faster with only one sensor set to STATe ON. Since this is the default configuration, you might want to turn one channel off occasionally. This will only be necessary when two sensors are attached and both are calibrated.

Channel configuration can be changed by sending the CALCulate:RATio or CALCulate:DIFFerence commands.

```
OUTPUT @Pwr_Mtr;"*RST"                          ! Configure 58542 to Default Setup
OUTPUT @Pwr_Mtr;"CALC1?;CALC2?"                 ! Query channel configuration
ENTER @Pwr_Mtr;Chn1_config,Chn2_config
PRINT Chn1_config,Chn2_config
    Program Output
    POW 1          POW 2
```

The following program reverses the default sensor-to-channel assignments.

```
OUTPUT @Pwr_Mtr;"CALC2:POW 1"                   ! Configures channel 2 to measure
                                                ! Sensor 1 power
OUTPUT @Pwr_Mtr;"CALC1:POW 2"                   ! Configures channel 1 to measure
                                                ! Sensor 2 power
OUTPUT @Pwr_Mtr;"CALC1?;CALC2?"                 ! Query channel  configuration
ENTER @Pwr_Mtr;Chn1_config,Chn2_config
PRINT Chn1_config,Chn2_config

    Program Output
    POW 2          POW 1
```

Ratio Measurement

The CALCulate:RATio command is used to automatically measure the ratio of the power levels incident on the two sensors. Permissible settings are Sensor 1/Sensor 2 & Sensor 2/Sensor 1.

```
OUTPUT @Pwr_Mtr;"CALC1:RAT 2,1"          ! Configures channel 1 to measure
                                         ! Sensor 2 over Sensor 1 power
OUTPUT @Pwr_Mtr;"CALC2:RAT 1,2"          ! Configures channel 2 to measure
                                         ! Sensor 1 over Sensor 2 power
OUTPUT @Pwr_Mtr;"CALC1?;CALC2?"          ! Query channel configuration
ENTER @Pwr_Mtr;Chn1_config,Chn2_config
PRINT Chn1_config,Chn2_config
```

Program Output

```
RAT2,1      RAT1,2
```

Difference Measurement

The CALCulate:DIFFerence command is used to automatically measure the difference of the power levels incident upon the two sensors.

```
OUTPUT @Pwr_Mtr;"CALC1:DIFF 2,1"         ! Configures channel 1 to measure
                                         ! Sensor 2 minus Sensor 1 power
OUTPUT @Pwr_Mtr;"CALC1?"                 ! Query Channel 1 configuration
ENTER @Pwr_Mtr;Chn1_config
PRINT Chn1_config
```

Program Output

```
DIFF2,1
```

Changing Measurements Units, dBm or mW

The 58542 VXI Power Meter can output measurement data expressed in logarithmic and/or linear units. Log measurement data is expressed in dBm. Linear measurement data is expressed in watts, W.

Cal Factor Correction

SENS#:CORR:FREQ
MEMory:FREQuency
MEMory:SELect
MEMory:SLOPe
MEMory:SENsor

Power Sensors have a measureable frequency response. During manufacture, this response is calibrated at 1 GHz intervals. Instead of printing the data on the sensor label, each Giga-tronics power sensor includes a built-in EEPROM which has been programmed with the frequency calibration factor data for that particular power sensor.

The following SCPI commands are used to tell the 58542 the operating frequency of the measured microwave or RF signal. Thus, the 58542 will automatically interpolate the correct Cal Factor and apply that value to the measurement data. By performing this automatically, you no longer need to read Cal Factor data from the side of sensor housings and program the data into tables within your ATE programming. Except for advanced measurement techniques using Burst Mode, you are no longer forced to write cal factor interpolation routines; this is all done by the power meter. As shown below, sensor Cal Factor data can be read into your computer. Also see the Sensor EEPROM Commands section on page 3-123 for Cal Factor progamming.

SENS#:CORR:FREQ

SENSe<sensor 1 or 2>:CORRection:FREQuency[:CW-FIXed] 5e7

```
OUTPUT@Pwr_mtr;"SENS2:CORR:FREQ 5e7"          ! Set sensor 2 frequency to 50 MHz
```

DESCRIPTION

This command allows you to correct for sensor frequency response characteristics. The 58542 VXI power meter uses this frequency value to automatically interpolate and apply the Cal Factor (computed from Cal Factor data points stored within each sensor's EEPROM) for that sensor. Unless the EEPROM has been modified subsequent to shipment, the Cal Factor is always 0.0 dB at 50 MHz, 5e7. Be sure to correct for sensor cal factor by using this command, using automated VpropF correction, by sending your own cal factor "REFerence" value, or by correcting for Cal Factor in your ATE system by downloading Cal Factor points for the 58542.

SENSe<sensor 1 or 2>:CORRection:FREQuency?

```
OUTPUT @Pwr_Mtr;"SENS1:CORR:FREQ?"          ! Query sensor 1 current frequency value
    Response is "+5.0000E+07"               ! for 50 MHz
```

DESCRIPTION

This command reports the current operating frequency setting for a particular sensor.

MEM:SEL

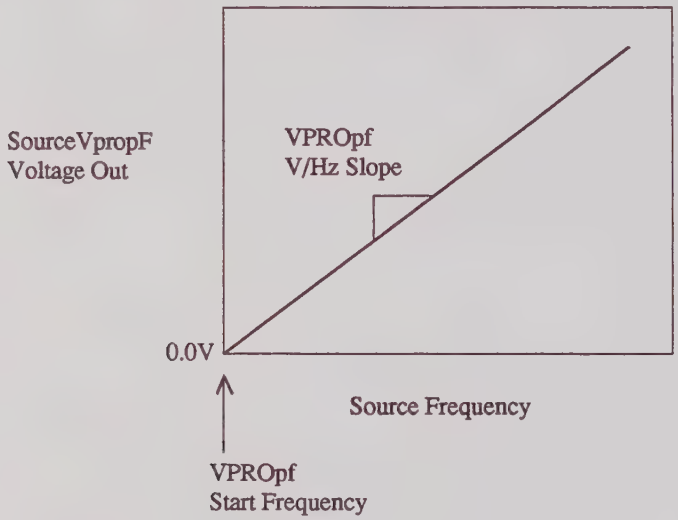
MEMory[:TABLe]:SELect*space*<ANALOGout,VPROPF1,VPROPF2>

```
OUTPUT@Pwr_mtr;"MEM:SEL VPROPF1"        ! Select memory table VPROPF1
                                        ! for editing in following lines
```

DESCRIPTION

This command selects between one of three editable tables. Using the 58542s' automated VpropF capability to correct for Cal Factor requires you to configure the "VpropF IN" input BNC (See front panel) to match the signal that your source will output. This is performed by setting the frequency so that your source's VpropF output is 0.0V. Then the slope relationship is entered in the form of a value representing the V/Hz relationship. If your source is a Giga-tronics 7000 Series Signal Generator, this relationship is 0.5V/GHz or 5e-8V/Hz.

VPROpf Configuration



MEMory[:TABLe]:SELect?

```
OUTPUT@Pwr_mtr;"MEM:SEL?"               ! Query the selected memory table
```

Response is the table currently editable; ANALOG, VPROPF1, or VPROPF2.

DESCRIPTION

This command reports the currently active, editable table.

MEM:SLOP

MEMory[:TABLe]:SLOPe*space*<Volts per Hz>

```
OUTPUT@Pwr_mtr;"MEM:SLOP 1e-9"          ! Set v_prop_f slope to 1V/GHz
```

DESCRIPTION

This command sets the V/HZ relationship for automated Cal Factor correction.

MEMory[:TABLe]:SLOPe?

OUTPUT@Pwr_mtr;"MEM:SLOP?" ! Query v_prop_f slope value

Response is the voltage to frequency value you set that corresponds to your source's VpropF output.

DESCRIPTION

This command returns the V/Hz slope relationship for VPROpf frequency correction.

MEM:FREQ

MEMory[:TABLe]:FREQuency*space* **<Start frequency>**

OUTPUT@Pwr_mtr;"MEM:FREQ 1e9" ! Set v_prop_f frequency to 1 GHz

DESCRIPTION

This command sets the automated VpropF correction start frequency. That is, the frequency at which the voltage input into the 58542 is 0.0V.

MEMory[:TABLe]:FREQuency?

OUTPUT@Pwr_mtr;"MEM:FREQ?" ! Query v_prop_f start frequency

Response is the frequency value you set that corresponds to your source's VpropF output at 0.0V.

DESCRIPTION

This VPROpf command reports the start frequency setting.

SENSe<sensor 1 or 2>:CORRection:VPROpf[:STATe]*space* **<ON-OFF>**

OUTPUT@Pwr_mtr;"SENS1:CORR:VPRO ON" ! Enable sensor 1 v_prop_f function

DESCRIPTION

Setting this control to ON activates VPROpf and deactivates SENS#:CORR:FREQ.

SENSe<sensor 1 or 2>:CORRection:VPROpf[:STATe]?

OUTPUT@Pwr_mtr;"SENS1:CORR:VPRO?" ! Query v_prop_f function status

Response is "1" or "0" for ON or OFF respectively.

DESCRIPTION

This command reports the ON or OFF status of VPROpf correction for the Sensor.

Frequency response variations (which are reflected in Cal Factors in Giga-tronics sensors) do not change appreciably over small frequency ranges. That is, the frequency that you send to the power meter does not need to be exact. If the actual measurement frequency is within about 40 MHz of the value sent to the power meter, your measurement variation due to this discrepancy will typically be less than 0.02 dB, well beneath typical RSS measurement accuracy levels.

Return Loss Bridges do not have Cal Factors loaded into their built-in EEPROMs. Because operation of return loss bridges require relative or referenced measurements, frequency response correction is unnecessary. Therefore, Giga-tronics Precision Return Loss Bridges are not programmed with Cal Factor data.

CAL FACTOR EXAMPLE PROGRAMS

Entering a frequency causes the power meter to use frequency calibration factors which are stored in the power sensors' internal EEPROM. Generally, frequency calibration factors are stored in one gigahertz steps.

Two methods are available for frequency entry. Use SENSe:CORRection:FREQuency to enter a specific carrier frequency, or use SENSe:CORRection:VPROpf to enable the 58542 VXI Power Meter's voltage proportional to frequency input BNC. (See front panel of the meter.)

The following program automatically applies the correct cal factor for an 8.23 GHz measurement frequency to the measured data value.

```
310  ASSIGN @Pwr_mtr to 70101
320  CLEAR @Pwr_mtr
330  WAIT 1
350  OUTPUT @Pwr_mtr;"CALC1:MODE NORMAL"      ! Can ONLY send Cal Factor Correction Commands in
                                              ! Normal Mode!!
360  !
370  OUTPUT @Pwr_mtr;"SENS1:CORR:FREQ 8.23E9" ! Applies Cal Factor for 8.23 GHz to measurement data.
380  !
400  OUTPUT @Pwr_mtr;"MEAS1?"                 ! Measures Power of 8.23 GHz signal.
410  ENTER @Pwr_mtr;Rdg
420  PRINT Rdg
460  !
470  END
```

The following program steps from 1.8 GHz to 2.2 GHz in 10 MHz intervals. The measurement at each step is automatically corrected for cal factor.

```
340  ASSIGN @Pwr_mtr to 70101
350  CLEAR @Pwr_mtr
360  WAIT 1
370  REAL Rdg(41)
380  REAL Frq(41)
```

```
390  OUTPUT @Pwr_mtr;"CALC1:MODE NORMAL"     ! Can ONLY send Cal Factor Correction Commands in
                                             ! Normal Mode!!
400  !
410  FOR I=1 TO 41
420  !
430  Freq=1.8E+9+(I-1)*1.E+7
440  OUTPUT @Pwr_mtr;"SENS1:CORR:FREQ";Freq  ! Applies Cal Factor to measurement data.
450  !
460  OUTPUT @Pwr_mtr;"MEAS1?"
470  ENTER @Pwr_mtr;Rdg(I)
480  OUTPUT @Pwr_mtr;"SENS1:CORR:FREQ?"      ! Power meter outputs freq setting to confirm command
                                             ! reception.
490  ENTER @Pwr_mtr;Frq(I)
500  NEXT I
510  !
520  PRINT Rdg(*)
530  PRINT Frq(*)
540  !
550  END
```

The following program also steps from 1.8 GHz to 2.2 GHz in 10 MHz intervals. The measurement at each step is automatically corrected for cal factor using the VpropF connector on the front panel. In the first part of the program the power meter's VpropF input is configured for compatibility with the Gigatronics Source.

```
340  ASSIGN @Pwr_mtr to 70101
350  CLEAR @Pwr_mtr
360  WAIT 1
370  REAL Rdg(41)
380  OUTPUT @Pwr_mtr;"CALC1:MODE NORMAL"     ! Can ONLY send VpropF Config. Commands in Normal
                                             ! Mode!!
390  !
400  ! Configure VpropF input for Cal Factor correction
410  !
420  OUTPUT @Pwr_mtr;"MEM:SEL VPROPF1"       ! Selects memory table for sensor on for editing
430  OUTPUT @Pwr_mtr;"MEM:FREQ 0.0"          ! Sets freq that corresponds to 0.0V out from source.
440  OUTPUT @Pwr_mtr;"MEM:SLOP 0.5E-9"       ! Sets the voltage to freq (must be linear) relationship of
                                             ! source's output (V/Hz).
450  !
460  OUTPUT @Pwr_mtr;"SENS1:CORR:VPRO ON"    ! Turns VpropF on and all other sources of Cal Factor
                                             ! correction OFF
470  !
480  FOR I=1 TO 41
490  !
500  Freq=1.8E+9+(I-1)*1.E+7
510  OUTPUT @Source;"CW";Freq;"HZ"
520  !
530  OUTPUT @Pwr_mtr;"MEAS1?"
540  ENTER @Pwr_mtr;Rdg(I)
550  NEXT I
560  !
570  PRINT Rdg(*)
580  !
590  END
```

The following program shows you how to input your own specific User Calibration Factor during measurement. This is not the same as the special Frequency Cal Factors that can be programmed into the EEPROM. (See Sensor EEPROM Commands on page 3-123 for more information) This a technique for you to apply a specific known value during your measurements. It is useful when you have performed a sensor calibration with other devices attached to the sensor input, such as a power splitter or coupler, but you do not want to change or reprogram the CAL Factor information inside the power sensor's EEPROM. First the program sets the 58542 to 50 MHz where the Cal Factors of Giga-tronics power sensors are always 0.0 dBm.

```
310  ASSIGN @Pwr_mtr to 70101
320  CLEAR @Pwr_mtr
330  WAIT 1
340  OUTPUT @Pwr_mtr;"CALC1:MODE NORMAL"        ! Can ONLY send Sensor Offset Commands in
                                                ! Normal Mode!!
350  !
360  OUTPUT @Pwr_mtr;"SENS1:CORR:FREQ 5E7"      ! Cal Factors always 0.00 dB at 50 MHz.
370  OUTPUT @Pwr_mtr;"SENS1:CORR:OFFS:STAT ON"  ! Enables sensor offset control.
380  OUTPUT @Pwr_mtr;"SENS1:CORR:OFFS 6.024"    ! Enters 6.024 dB as a Sensor Offset.
390  !
400  OUTPUT @Pwr_mtr;"MEAS1?"                   ! Measures Power
410  ENTER @Pwr_mtr;Rdg
420  PRINT Rdg
430  !
440  END
```

In Burst and Swift Mode, the 58542s' functionality is restricted to allow the microprocessor to devote most of its operation to performing measurement operations. If you are measuring a single frequency, you will not need this technique for your Burst or Swift Mode data. In Burst or Swift Mode, measurement correction for Cal Factor is always performed with the SENS:CORR:FREQ ### command. By sending this command before you enter the Burst or Swift Mode from the Normal mode, all subsequent Burst or Swift Mode measurements will be corrected for that frequency.

The above operation creates a problem for you if you change frequency during Burst or Swift Mode measurement. The following program is used to apply correct cal factors to swept or multi frequency measurements that have been performed during Burst or Swift Modes. In these modes, swept measurement correction functions are performed in your computer, thus increasing the measurement speed more than would otherwise be possible. First the Cal Factors are read from the sensor's EEPROM. Then the Cal Factors are put through an interpolation algorithm into a correction data array that matches the start/stop frequencies of the test source and the number of measurement points to be collected during measurement. Then measurement is performed, and the correction factor array is added to the measurement data array before being output to a file or swept onto a screen display.

```
10   ALPHA ON
20   CLEAR SCREEN
30   OPTION BASE 1
40   !
50   DIM Freqs(80),Clfcs(80),Corr_clf(5000),Rdgs(5000),Rdgs_corr(5000)   ! These are in REDIMs later in program
```

```
60   DIM Id$[90],Err_msg$[70]
70   DIM Ques$[200],Calf$[200]
80   !
90   Tim_per_pnt=5  ! milliseconds per sample point. Set 1 to 999.
100  !
110  !################################################
120  !       Instrument ADDRESS ALLOCATION
130  !
140  ASSIGN @Slot0 TO 70100                          ! 70100 is Logical Address of the Slot 0
                                                     ! controller (Resource Manager)
150  ASSIGN @Sweeper TO 720                          ! Use normal address for non-VXI
                                                     ! instruments
160  ASSIGN @Pwr_mtr TO 70101                        ! Power Meter is next to the slot 0
                                                     ! Resource Manager
170  !################################################
180  !
190  ! Identify Attached Instruments
200  !
210  OUTPUT @Slot0;"*IDN?"
220  ENTER @Slot0;Id$
230  PRINT "SLOT 0 is ";Id$
240  !
250  OUTPUT @Pwr_mtr;"*IDN?"
260  ENTER @Pwr_mtr;Id$
270  PRINT "SLOT 1 is ";Id$
280  WAIT 1
290  !
300  !#######################################
310  !
320  !   CALIBRATE THE SENSORS
330  !
340  !#######################################
350  !
360  CLEAR @Pwr_mtr
370  WAIT 1
380  OUTPUT @Pwr_mtr;"CALC1:MODE NORMAL"             ! Can ONLY send Sensor Offset
                                                     ! Commands in Normal Mode!!
390  !
400  OUTPUT @Pwr_mtr;"SENS1:CORR:FREQ 5E7"           ! Cal Factors always 0.00 dB at 50 MHz.
410  !
420  !  Find out the number of Cal Factors in EEPROM
430  !  Includes Std Cal Factors at 1 GHz intervals and any special Cal Factors.
440  !
450  OUTPUT @Pwr_mtr;"DIAG:SENS1:EEPROM:CALFR?"
460  !ENTER @Pwr_mtr;Frst_std_freq,Std_freq_step,No_std_freqs,No_spl_freqs
470  ENTER @Pwr_mtr;Frst_std_freq,Std_freq_step,No_std_freqs
480  No_spl_freqs=1   ! Added to correct bug in DIAG:SENS#:EEPROM:CALFR?
490  PRINT Frst_std_freq,Std_freq_step,No_std_freqs,No_spl_freqs
500  !
510  !
520  ! When you query the 58542 for frequencies and Cal Factors there will be
530  !  No_std_freqs + No_spl_freqs = number of items you need to read
540  !
550  No_cal_pnts=No_std_freqs+No_spl_freqs
```

```
560  REDIM Freqs(No_cal_pnts),Clfcs(No_cal_pnt)                ! Dimension according to number of
                                                               ! Cal Factors to be read in.
570  PRINT "There are";No_cal_pnts;"of Cal Factors in this sensor."
580  !
590  OUTPUT @Pwr_mtr;"SENS1:CORR:EEPROM:FREQ?"                 ! Asks the 58542 for the Frequency
                                                               ! array from sensor 1
600  ENTER @Pwr_mtr;Freqs(*)
610  PRINT Freqs(*)
620  !
630  OUTPUT @Pwr_mtr;"SENS1:CORR:EEPROM:CALF?"                 ! Asks the 58542 for the Frequency
                                                               ! array from sensor 1
640  ENTER @Pwr_mtr;Clfcs(*)
650  PRINT Clfcs(*)
660  !
670  !###############################################################################
680  ! Now that all the Cal Factors are loaded with their corresponding frequencies,
690  ! we need to create a table of interpolated Cal Factor points based upon the frequencies used
700  ! and number of measurement points in the test program.
710  !
720  ! First get a couple pieces of necessary information
730  !
740  INPUT "Input sweep START frequency in GHz.",Strt_freq
750  INPUT "Input sweep STOP frequency in GHz.",Stop_freq
760  INPUT "Number of points per sweep.  100 to 400 suggested.",Swep_pnts
770  IF Strt_freq>Stop_freq THEN
780   PRINT "Make STOP freq. > START freq."
790   WAIT 1
800   GOTO 740
810  ELSE
820   IF Strt_freq<.051 THEN GOTO 740
830   IF Swep_pnts<1 THEN GOTO 740                             ! You can put additional requirements
                                                               ! in this section.
840  END IF
850  Strt_freq=1.E+9*Strt_freq
860  Stop_freq=1.E+9*Stop_freq   ! Set units to Hz
870  REDIM Corr_clf(Swep_pnts),Rdgs(Swep_pnts),Rdgs_corr(Swep_pnts)   ! Re-sized to match number of measure-
                                                               ! ment points in sweep.
880  !
890  ! Interpolation routine creates Cal Factor Correction Table in Clf_corr(*)
900  ! Values are in dB!!!!  NOT W linear units
910  !
920  FOR I=1 TO Swep_pnts  ! For each point in Clf_corr(*)
930   Rdgs(I)=1
940   Corr_freq=Strt_freq+(I-1)*(Stop_freq-Strt_freq)/(Swep_pnts-1)   ! Corr_freq is freq corresponding to
                                                               ! Clf_corr(I)
950   FOR K=1 TO No_cal_pnts                                   ! Find next highest and lowest Cal Factor
                                                               ! frequency from Corr_freq
960    IF Freqs(K)>=Corr_freq THEN
970     Next_higher_f=Freqs(K)
980     Next_higher_clf=Clfcs(K)
990     Next_lower_f=Freqs(K-1)
1000     Next_lower_clf=Clfcs(K-1)
1010     K=No_cal_pnts
1020  !
1030    END IF
```

```
1040   NEXT K
1050   F_delta_multpl=(Corr_freq-Next_lower_f)/(Next_higher_f-Next_lower_f)        ! Multiplier for next formula
1060   Corr_clf(I)=Next_lower_clf+F_delta_multpl*(Next_higher_clf-Next_lower_clf) ! Interpolates the Cal Factor
                                                                                  ! Value
1070   PRINT Corr_freq,Corr_clf(I)
1080 NEXT I
1090 !
1100 ! Set the source for swept operation
1110 !
1120 PRINT "Configuring Gigatronics 7200 Microwave Sweeper."
1130 OUTPUT @Sweeper;"HP"                                    ! Set Giga-tronics 7200 to HP
                                                             ! emulation mode
1140 OUTPUT @Sweeper;"OPFA";Strt_freq
1150 OUTPUT @Sweeper;"OPFB";Stop_freq
1160 OUTPUT @Sweeper;"FC";Tim_per_pnt*Swep_pnts;"MS"
1170 !
1180 ! Perform Measurement in Burst Mode or Swift Mode for Fast measurements.
1190 ! Shared Variables may include Sweep_pnts and Tim_per_pnt
1200 !
1210 GOSUB Burst_mode_swp                                  ! Goes to the swept frequency,
                                                          ! Burst/Swift Mode Data acquisition
                                                          ! subroutine
1220 !
1230 ! Data comes back in from Burst Mode-or Swift Mode-as rdgs(*).  Always in log units, dBm.
1240 !
1250 MAT Rdgs_corr=Rdgs+Corr_clf                          ! Array math function that adds the measure-
                                                          ! ment data to the cal factor array
1260 !
1270 GOSUB Output_data                                    ! Output to screen graph, printout, file, etc.....
1280 !
1290 END
```

CAL FACTOR ERROR CONTROL

(See Error Messages on page 129)

Selected basic SCPI syntax and execution errors apply to these commands.

Device specific errors include the following and other -300 level errors.

A common device specific error occurs when the frequency sent to the 58542 in the SENS#:CORR:FREQ ### command is outside the range of the sensor's operating frequency range. For example, sending SENS1:CORR:FREQ 18.4e9 when an 18 GHz max. 80301A CW Power Sensor is attached will yield a device specific error.

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High Speed Measurements

CALCulate:DATA?
CALCulate:MODE
TRIGger:MODE
TRIGger:DELay
TRIGger:COUNt

Measurements in Normal mode are fastest with only one sensor attached. When two sensors are attached, the Normal mode measurement rate is reduced. This applies for all three major measurement commands, FETCh, READ, and MEASure. Both of the averaging types, MOVing and REPeat, slow down when in the Normal mode. MOVing provides faster averaging; the speed is equivalent to REPeat whenever the Averaging number is 1.

When performing measurements in either Swift or Burst Modes, measurement rates are the same with two sensors as with one sensor.

CALC:DATA?

CALCulate<channel 1 or 2>:DATA?

```
OUTPUT @Pwr_Mtr;"CALC1:DATA?"          ! Query channel 1 & 2 BURSt mode data
```

DESCRIPTION

This command interrupts the burst measurement and dumps the measurement buffer. All empty locations will be filled with -300 before the data dump. The Burst mode remains active after this command so that a trigger will start a new measurement reference.

The command is used to return measurement data (while the measurement is completing) during BURSt Mode only. This command is not used in NORMal or SWIFt Modes. Operation is similar to using FETCh? Both are instrument (not channel) commands. That is, when both sensors are connected, calibrated, and the channel set to ON, this command will return power level data for both channels.

Mode Control, Operating

The Operating mode is controlled through the CALC#:MODE command. The choices are NORMal, BURSt, and SWIFt. Please note that sending CALC1:MODE will set the operating mode for the entire instrument, not just for channel 1. For example, you can not send CALC1:MODE BURS, and then CALC2:MODE SWIF to get channel 1 in BURSt mode and channel 2 in SWIFt Mode. After the CALC2:MODE SWIF command, both channels are in SWIFt Mode.

CALC:MODE

CALCulate<channel 1 or 2>:MODE*space* <NORMal, BURSt, or SWIFt Mode Selection>

```
OUTPUT@Pwr_mtr;"CALC2:MODE SWIF  "          ! Set measurement mode to SWIFT
```

DESCRIPTION

This command sets the measurement mode. This is NOT a channel specific command; it is an instrument configuration command. Selecting one channel changes both channels

to the desired mode. Use this command to select the level of functionality and performance for your unique applications. NORMal Mode is full functioned. SWIFt Mode allows individual data point triggering. BURSt Mode allows the fastest measurement rates.

CALCulate<channel 1 or 2>:MODE?

```
OUTPUT@Pwr_mtr;"CALC1:MODE?"          ! Query 58542 measurement mode
```

Response is "NORM", "SWIF", or "BURS".

DESCRIPTION

This query returns the current operating mode.

NOTE: The commands that follow are duplicates of those given in the Instrument Triggering section of this chapter, and are shown here for convenience. These commands must be used with BURSt mode operation.

TRIG:MODE

TRIGger:MODE*space***<burst mode data gathering POST trigger receipt or PRE trigger receipt>**

```
OUTPUT@Pwr_mtr;"TRIG:MODE POST"       ! Set Burst or Swift mode data collection
                                      ! relative to Timing of event trigger post
```

DESCRIPTION

This command is only for BURSt Mode measurements. Send this command only after CALC#:MODE BURS. TRIG:MODE controls the operation of the FIFO data buffer inside the 58542. When set to POST, the burst of data points is taken after the receipt of a valid instrument trigger. When set to PRE, the burst of data is assumed to be those data points that have arrived immediately preceding the valid instrument trigger event. Using PRE requires some caution: the single processor inside the 58542 is performing data acquisition constantly. If you send any configuration commands while the 58542 is collecting the PRE trigger data, you may inadvertantly interrupt the timing of the data point collection.

TRIGger:MODE?

```
OUTPUT @Pwr_mtr;"TRIG:MODE?"          ! Query Burst or Swift mode returns
```

Response is "PRE" or "POST".

DESCRIPTION

This query command responds with the current setting of the BURSt mode pre or post triggered data collection. Query can be used in any operating mode.

TRIG:DEL

TRIGger:DELay*space***<delay time between buffered readings in sec, 0.000 to 5.000>**

```
OUTPUT @Pwr_mtr;"TRIG:DEL 5e-3"       ! Set Burst mode measurement time to
                                      ! 5 ms between measurements.
OUTPUT @Pwr_mtr;"TRIG:DEL 0"          ! Max. measurement rate, 5100/sec.
                                          (resolution, one msec)
```

DESCRIPTION

This command applies only to BURSt Mode. It sets the time interval between the measurements; it is accurate to about 5%. This is the only way to control the 58542s' data acquisition of individual data points in a burst measurement. Burst measurement data is taken following or just prior to a single instrument trigger event. The number of measurements taken is controlled by TRIG:COUNt. Timing can be set in 0.001 second increments from 0.000 to 5.000, inclusive. Setting this control to 0.000 activates the highest reading rate possible with the 58542; 5100 readings per second.

Please remember that triggering of the Peak Power Sensor occurs independently from instrument triggering. Therefore, there is a moderate ability to control triggering at the Peak Power Sensors. Generally, if you require control of individual data point triggering, SWIFt mode will provide the highest measurement rates, with or without srq or hardware handshaking. Please note that the 58542 controls its gain ranges transparently by verifying internal range changes just before and just after individual measurement points. If the internal range does not remain the same, the data point will be discarded as invalid

TRIGger:DELay?

```
OUTPUT @Pwr_mtr;"TRIG:DEL?"          ! Query Burst mode measurement time
                                     ! returns delay value
```

Response is a single number indicating the number of seconds between readings. Resolution to 0.001.

DESCRIPTION

This query returns the current setting of delay time interval between burst mode data points.

TRIG:COUN

TRIGger:COUNt*space*<number of data values to buffer in memory form 1 to 5000 for standard 58542s, from 1 to 128,000 on one channel with option 02 and 1 to 64000 for two channels with option 02>

```
OUTPUT@Pwr_mtr;"TRIG:COUN 100"       ! Set Burst or Swift mode buffer reading
                                     ! number to 100
```

DESCRIPTION

The 58542 has an internal - and expandable - data buffer for storing measurement data until the slot 0 controller/resource manager is ready to read the data. During SWIFt or BURSt modes, this command controls the number of power readings that are stored in the 58542 data buffer.

The value specified here applies to each individual channel. That is, if two sensors are attached and calibrated, the 58542 will perform the specified measurement and buffering for both channels. In the example above, that would be 100 points per channel. Option 02 adds additional memory for 128,000 data point buffering. This applies only to a single channel. When two sensors are attached and calibrated, the maximum is 64,000 readings per channel.

During BURSt mode, the COUNt # of readings will be taken with just one instrument trigger. During SWIFt Mode however, you can control the triggering of individual data points. If you set triggering to EXT, the 58542 will perform one measurement each time a

TTL level signal is detected by the 58542. Then the value is stored in the data buffer. This continues until the 58542 has received and operated the COUNt # of triggers and also read in the COUNt # of data points to the buffer.

TRIGger:COUNt?

```
OUTPUT@Pwr_mtr;"TRIG:COUN?"          ! Query Burst or Swift mode buffer
                                     ! number
```

Response is a single number - the number of data points stored in memory during Burst or Swift modes.

DESCRIPTION

This query returns the current setting of the number of data points to collect in the 58542s' internal data buffer during BURSt or SWIFt Mode.

Approximate Measurement Speeds

Table 3-C. 58542 Approximate Measurement Speeds (in readings per second)

Range (dBm)	22 to 4	6 to -10	-7 to -21	-18 to -30	-27 to -37	-35 to -48	-46 to -66	-64 to -99
Normal 1	53	53	53	53	53	53	53	53
Normal 2	23	23	23	23	24	6.9	6.6	5.8
Normal 3	22	22	22	16	17	0.5	**0.06	**0.06
Swift Imm	71	71	71	71	71	71	71	71
Swift Bus 1	39	39	39	39	40	25	25	25
Swift Bus 2	53	53	53	53	56	24	24	24
Swift Ext	*150	*150	*150	*150	*150	*150	*150	*150
***Burst	5100	5100	5100	5100	5100	5100	5100	5100

* HP 9000-300 Computer, HP BASIC Language, HP-E1505B Controller
** Speed will be 0.24 for average number of 32, and 0.12 for average number of 64
*** Speed only includes measurement time

Normal 1: SENS1:AVER:TCON MOV
INIT:COUN ON
FETC1

Normal 2: SENS1:AVER:TCON MOV
MEAS1?

Normal 3: SENS1:AVER:TCON REP
MEAS1?

Swift Imm

Swift Bus 1: (SRQ Handshake)

Swift Bus 2: (without SRQ Handshake)

Swift Ext: (without TTL Handshake)

Burst

Triggering Notes (also see the Instrument Triggering section on page 3-43 for more information) EXT triggering is performed with the front panel BNC connector and will only work in BURSt and SWIFt Modes. EXT triggering is not available in NORMal Mode. Provision has been made for a hardware "ready" type handshaking capability using the analog output. This feature can be used as a loop back test when performing troubleshooting procedures.

BUS triggering is available for all operating modes, BURSt, SWIFt and NORMal.

IMMediate triggering is not compatible with BURSt and SWIFt Modes. If you send the CALC#:MODE BURS command to enter the BURSt Mode, IMM instrument triggering for NORMal Mode will automatically be switched to TRIG:SOUR BUS. If you use the CALC#:MODE SWIF

command to enter the SWIFt Mode, IMM instrument triggering will remain IMM, but a device specific error will be generated whenever you specify a TRIG:COUN # higher than 1. Using the FETCh#? measurement query, you can take accurate measurements anyway; don't set TRIG:COUN.

Using FETCh#? when you have time dependent measurement processes can be a little tricky unless you use srqs. If the 58542 hasn't had enough time to process the measurement or has not received a trigger, it will return an abnormally large number - 9.e40 is common, but other obviously invalid readings can occur. Not using srqs is fastest for measurement speed, but you'll have to manage the measurement/triggering timing problem closely.

Measurement Level Notes.
The SWIFt Mode should not be used for measuring power in the bottom 10 dB of the CW dynamic range. At low power levels, the NORMal mode reduces the measurement speed to account for the effects of noise.

EXAMPLE PROGRAMS

The following program shows the fastest SWIFt Mode measurement speed possible. IMMediate triggering is used to allow the 58542 to trigger a measurement automatically. Be sure to only use one channel defined to one sensor for the fastest speeds.

```
170  ASSIGN @Pwr_mtr to 70101
180  CLEAR @Pwr_mtr
190  WAIT 1
200  OUTPUT @Pwr_mtr;"*CLS"                    ! Clears old messages from SYST:ERR buffer
210  WAIT 0.3
220  OUTPUT @Pwr_mtr;"CALC1:MODE NORM"         ! NORMal Mode to perform channel configuration
230  OUTPUT @Pwr_mtr;"CALC1:POW 1"             ! Channels 1 or 2 can be either POW 1 or POW 2
240                                            ! RAT and DIFF are illegal in SWIFt and BURSt
                                               ! Modes.
250  !
260  !#################################################
270  !
280  ! Entering SWIFt Mode
290  !
300  OUTPUT @Pwr_mtr;"CALC1:MODE SWIF"         ! Enters SWIFt Mode for fastest continuous
                                               ! measurements with IMM.
310  !
320  OUTPUT @Pwr_mtr;"SENS1:CORR:FREQ 16.97E9" ! Applies Cal Factor in SWIFt mode
330                                            ! Can be sent before or after CALC#:MODE SWIF
340  !
350  OUTPUT @Pwr_mtr;"TRIG:SOUR IMM"
360
370  !
380  !
390  Loopcount=100
400  Time1=TIMEDATE
410  FOR I=1 TO Loopcount
420     OUTPUT @Pwr_mtr;"FETC1?"               ! FETC#? acquires data
```

```
430     ENTER @Pwr_mtr;Chan1sens_1(I)
440   NEXT I
450   Time2=TIMEDATE
460   Time=Time2-Time1
470   Speed=Loopcount/Time                          ! Units are readings per second.
480   !
490   PRINT Chan1sens_1(*)
500   PRINT Speed;" readings per second."
510   !
520   END
```

Using one of the slowest system configurations available, external PC controller with GPIB slot 0 resource manager and programming through a very slow Basic program, the previous program achieved a speed of 24 readings per second. With faster systems using embedded PCs and faster software, measurement speeds have been recorded as high as 71 readings per second.

```
10    ALPHA ON
20    CLEAR SCREEN
30    !
40    OPTION BASE 1
50    DIM Id$[50],Err_msg$[70]
60    DIM Ques$[200],A$[80],Chan1sens_1(200)
70    DIM Chan2sens_2(200)
80    Counter=1
90    !
100   !################################################
110   !       Instrument ADDRESS ALLOCATION
120   !
130   ASSIGN @Slot0 TO 70100                        ! 70100 is Logical Address of the Slot 0 controller
140   ASSIGN @Pwr_mtr TO 70101                      ! 70101 is Power Meter in 1st position right of slot 0
150   !################################################
160   !
280   !
290   CLEAR @Pwr_mtr
300   WAIT 1
310   OUTPUT @Pwr_mtr;"*CLS"                        ! Clears old messages from SYST:ERR buffer
320   WAIT 0.3
330   OUTPUT @Pwr_mtr;"CALC1:MODE NORM"             ! NORMal Mode to perform channel configuration
340   OUTPUT @Pwr_mtr;"CALC1:POW 1"                 ! Channels 1 or 2 can be either POW 1 or POW 2
350                                                 ! RAT and DIFF are illegal in SWIFt and BURSt
                                                    ! Modes.
370   !
380   !################################################
390   !
400   ! Entering SWIFt Mode
410   !
420   OUTPUT @Pwr_mtr;"CALC1:MODE SWIF"             ! Enters SWIFt Mode for fastest continuous
                                                    ! measurements with IMM.
430   !
440   OUTPUT @Pwr_mtr;"SENS1:CORR:FREQ 16.97E9"     ! Applies Cal Factor in SWIFt mode
450                                                 ! Can be sent before or after CALC#:MODE SWIF
460   !
470   OUTPUT @Pwr_mtr;"TRIG:SOUR IMM"               ! IMM triggering is illegal in SWIFt Mode, Use BUS
                                                    ! or EXT.
```

```
480                                                  ! Can be sent before or after CALC#:MODE SWIF
490  !
610  !
611  Loopcount=50
613  Time1=TIMEDATE
620  FOR I=1 TO Loopcount
670    !OUTPUT @Pwr_mtr;"FETC1?"                    ! FETC#? acquires data
671     OUTPUT @Pwr_mtr;"FETC1?;FETC2?"             ! Use this line when two sensors are attached.
680    !ENTER @Pwr_mtr;Chan1sens_1(I)
681     ENTER @Pwr_mtr;Chan1sens_1(I),Chan2sens_2(I) ! Use this line when two sensors are attached.
730  NEXT I
731  Time2=TIMEDATE
733  Time=Time2-Time1
743  Speed=Loopcount/Time                            ! Units are readings per second.
753  !
763  !PRINT Chan1sens_1(*)
773  PRINT Chan1sens_1(*),Chan2sens_2(*)             ! Use this line when two sensors are attached.
783  !PRINT Speed;" readings per second."
784  PRINT Speed;" readings per second per channel."
793  !
803  END
```

Using the same system configuration, the previous program achieved a speed of 25 readings per second per channel. With faster systems using embedded PCs and faster software, measurement speeds have been recorded as high as 71 readings per second.

The following program shows fast BUS triggering in the SWIFt Mode. TRIG (or *TRG) is used to acquire data, and FETCh#? processes and outputs the data to the slot 0 controller/resource manager. This program does not use the 58542s' data buffering capability.

```
170  ASSIGN @Pwr_mtr to 70101
180  CLEAR @Pwr_mtr
190  WAIT 1
200  OUTPUT @Pwr_mtr;"*CLS"                          ! Clears old messages from SYST:ERR buffer
205  WAIT 0.3
210  PRINT "Running..."
220   !
230  OUTPUT @Pwr_mtr;"CALC1:MODE NORM"               ! NORMal Mode to perform channel configuration
240  OUTPUT @Pwr_mtr;"CALC1:POW 1"                   ! Channels 1 or 2 can be either POW 1 or POW 2
250                                                  ! RAT and DIFF are illegal in SWIFt and BURSt
                                                     ! Modes.
260  !
270  !#####################################################
280  !
290  ! Entering SWIFt Mode
300  !
310  OUTPUT @Pwr_mtr;"CALC1:MODE SWIF"               ! Enters SWIFt Mode for fastest individual data point
                                                     ! triggered measurements.
320  !
330  OUTPUT @Pwr_mtr;"SENS1:CORR:FREQ 1.44E9"        ! Applies Cal Factor in SWIFt mode
340                                                  ! Can be sent before or after CALC#:MODE SWIF
350  !
```

```
360  OUTPUT @Pwr_mtr;"TRIG:SOUR BUS"                ! BUS or EXT triggering is slower than IMM
370                                                 ! Can be sent before or after CALC#:MODE SWIF
380  !
390  FOR I=1 TO 10
400   FOR K=1 TO 20
410    OUTPUT @Pwr_mtr;"TRIG"                       ! TRIG is the SCPI Bus trigger. Can also use *TRG
420    OUTPUT @Pwr_mtr;"FETC1?"                     ! FETC#? acquires data
430    ENTER @Pwr_mtr;Chan1sens_1(K)
440    !ENTER @Pwr_mtr;Chan1sens_1(K),Chan2sens_2(K)  ! Use this line when two sensors are attached.
450   NEXT K
460   !
470   PRINT Chan1sens_1(*)
480   !PRINT Chan1sens_1(*),Chan2sens_2(*)          ! Use this line when two sensors are attached.
490   PRINT ""
500  NEXT I
510  !
520  END
```

The following program shows SWIFt Mode measurements using EXT TTL triggering and Buffered data. INIT:CONT must be set to ON; you can not use INIT with INIT:CONT set to OFF. This program buffers 30 measurements in the 58542 before group download to the controller using the TRIG:COUN command in line 390. In the SWIFT mode, this command must be sent after the TRIG:SOUR command.

```
170  ASSIGN @Pwr_mtr to 70101
180  CLEAR @Pwr_mtr
190  WAIT 1
200  OUTPUT @Pwr_mtr;"*CLS"                         ! Clears old messages from SYST:ERR buffer
210  WAIT 0.3
220  OUTPUT @Pwr_mtr;"CALC1:MODE NORM"              ! NORMal Mode to perform channel configuration
230  OUTPUT @Pwr_mtr;"CALC1:POW 1"                  ! Channels 1 or 2 can be either POW 1 or POW 2
240                                                 ! RATio and DIFFerence configurations are illegal in
                                                    ! SWIFt and BURSt Modes.
250  !
260  !#################################################
270  !
280  ! Entering SWIFt Mode
290  !
300  OUTPUT @Pwr_mtr;"CALC1:MODE SWIF"              ! Enters SWIFt Mode for fastest individual data point
                                                    ! triggered measurements.
310  !
320  OUTPUT @Pwr_mtr;"SENS1:CORR:FREQ 2.22E8"       ! Applies Cal Factor in SWIFt mode
330                                                 ! Can be sent before or after CALC#:MODE SWIF
340  !
350  OUTPUT @Pwr_mtr;"TRIG:SOUR EXT"                ! TTL level triggering, Each trigger acquires one
                                                    ! data point in SWIFt Mode.
360                                                 ! Can be sent before or after CALC#:MODE SWIF
370  !
380  Num_pts=30
390  OUTPUT @Pwr_mtr;"TRIG:COUN ";Num_pts           ! Stores 20 points for simultaneous output using FETCh#?.
400                                                 ! Must be sent after CALC#:MODE SWIF
410  !
420  REDIM Chan1sens_1(Num_pts),Chan2sens_2(Num_pts)
```

```
430  !
440  Time1=TIMEDATE
450   WAIT 5                                    ! If necessary, use wait statements
460                                             ! For example, use it if TRIG:COUN # is high or TTL
                                                ! trigger source is slow.
470   OUTPUT @Pwr_mtr;"FETC1?"                  ! FETC#? acquires data
480   !OUTPUT @Pwr_mtr;"FETC1?;FETC2?"
490   ENTER @Pwr_mtr;Chan1sens_1(Num_pts)
500  !ENTER @Pwr_mtr;Chan1sens_1(Num_pts),Chan2sens_2(Num_pts)  ! Use this line when two sensors are attached.
510  Time2=TIMEDATE
520  Time=Time2-Time1
530  Speed=Num_pts/Time
540   !
550   PRINT Chan1sens_1(*)
560   !PRINT Chan1sens_1(*),Chan2sens_2(*)       ! Use this line when two sensors are attached.
570  PRINT Speed;" readings per second."
580   PRINT ""
590  !
600  END
```

The following program uses BURSt Mode for the fastest measurement rates possible. The maximum measurement speed is performed when TRIG:DEL is set to 0. TRIG:DEL controls the speed of sampling and data buffering. When TRIG:DEL is set to 0.004, samples will be taken every 4 milliseconds, on both channels if connected, and stored in the 58542s' internal data buffer. This speed does not control or account for the 58542s' internal data processing time after data acquisition or the speed of data transfer to your controller. This second component of time, the time to get data from the 58542, is proportional to the number of data points measured. Therefore, the example below uses only one channel and keeps the number of points buffered to a minimum.

Both channels' data will be taken at the same time during BURSt Mode. Power meter measurement speed does not change when two sensors are connected versus only one sensor. However, the 58542 processing time and the time to transmit the data over the VXI and GPIB interfaces takes longer due to the additional sensor data. If two sensors are connected, calibrated, and their respective channels are set to ON, then you must read both arrays of data. Only read one array of data when one sensor is attached, calibrated, and set to ON.

As shown in the examples, send the CALC#:MODE BURS command prior to sending the BURSt Mode configuration commands TRIG:SOUR, TRIG:MODE, TRIG:COUN, and TRIG:DEL.

```
10   ALPHA ON
20   CLEAR SCREEN
30   !
40   OPTION BASE 1
50   DIM Id$[50],Err_msg$[70]
60   DIM Ques$[200],A$[80],Chan1sens_1(500)
70   DIM Chan2sens_2(500)
80   !
90   !
100  !################################################
110  !       Instrument ADDRESS ALLOCATION
```

```
270 !
280 !
290 CLEAR @Pwr_mtr
300 WAIT 1
310 OUTPUT @Pwr_mtr;"*CLS"                    ! Clears old messages from SYST:ERR buffer
320 WAIT 0.3
330 OUTPUT @Pwr_mtr;"CALC1:MODE NORM"         ! NORMal Mode to perform channel configuration
340 OUTPUT @Pwr_mtr;"CALC1:POW 1"             ! Channels 1 or 2 can be either POW 1 or POW 2
350                                           ! RAT and DIFF are illegal in SWIFt and BURStModes.
360 !
370 !###############################################
380 !
390 ! Entering BURSt Mode
400 !
410 OUTPUT @Pwr_mtr;"CALC1:MODE BURS"         ! Enters BURSt Mode for fastest measurement speeds.
420 !
430 OUTPUT @Pwr_mtr;"SENS1:CORR:FREQ 2.44E9"  ! Applies Cal Factor in burst mode
440                                           ! Can be sent before or after CALC#:MODE BURS
450 !
460 OUTPUT @Pwr_mtr;"TRIG:SOUR EXT"           ! EXT TTL Level input begins BURSt Mode
                                              ! measurement.
470                                           ! Can be sent before or after CALC#:MODE BURS
480 !
490 OUTPUT @Pwr_mtr;"TRIG:MODE POST"          ! Data acquired after trigger, not before as with PRE.
500                                           ! Send only after CALC#:MODE BURS
510 !
520 OUTPUT @Pwr_mtr;"TRIG:COUN 500"           ! 500 readings acquired and stored with each trigger.
530                                           ! Send only after CALC#:MODE BURS, following
                                              ! TRIG:MODE.
540                                           ! Be sure COUN# matches ENTER variable dimension.
550 !REDIM Chan1sens_1(500),Chan2sens_2(500)  ! REDIM to smaller array size only if necessary.
560 !
570 OUTPUT @Pwr_mtr;"TRIG:DEL .000"           ! 0 millisecond between rdgs setting is 5100 rdgs/sec.
580                                           ! Send only after CALC#:MODE BURS, following
                                              ! TRIG:COUN.
590 !
600 !
610 FOR I=1 TO 10
620 !WAIT .01                                 ! Wait for trigger compensation.  If necessary, use wait
                                              ! statements
630
640
650  Time1=TIMEDATE
660  !
670  OUTPUT @Pwr_mtr;"FETC1?"                 ! FETC#? acquires data
680  WAIT 2  ! for POST triggering
690  ENTER @Pwr_mtr;Chan1sens_1(*)
700 !ENTER @Pwr_mtr;Chan1sens_1(*),Chan2sens_2(*)  ! Use this line when two sensors are attached.
710  !
720  Time2=TIMEDATE
730  Time=Time2-Time1
740  Speed=500/Time
750  PRINT Chan1sens_1(*)
760 !PRINT Chan1sens_1(*),Chan2sens_2(*)       ! Use this line when two sensors are attached.
```

```
770   PRINT Speed;" readings per second, round trip."
780   PRINT ""
790 NEXT I
800 !
810 END
```

The preceding program performs measurement at approximately 5100 measurements per second. Assuming pretriggering during the PRINT statements, a round trip speed of 180 to 195 measurements per second was achieved.

Peak Power Sensor Triggering

SENSe:TRIGger

The Peak Power Sensors sample power levels almost instantaneously. Since there is a sampler built into the Peak Power sensor housing, there are several controls to configure the source of the sensor trigger signal. These include the delay time from triggering to when the sample is to be taken (Sample Delay), and the trigger level.

All Peak Power Sensors will operate in the SWIFt and BURSt modes when in the CW measurement mode (SOURce) configuration (not when using INT or EXT trigger).

SENSe<sensor 1 or 2>:TRIGger:SOURce*space* <INTernal, EXTernal, or CW>
OUTPUT@Pwr_mtr;"SENS1:TRIG:SOUR CW" ! Set sensor 1 peak trigger mode to CW mode

DESCRIPTION

This command controls the trigger source for the sensors. Both the 80350A Series and 80340 Series of Peak Power Sensors respond to this command. INTernal triggering is performed automatically by the 80350A Sensor; however, the trigger level must be set to a value of power that is lower than the power level of the pulsed signal incident upon the sensor. EXTernal triggering is performed by inputting a baseband pulse into the rear connector on the sensor housing. BNC to SMB cables have been provided for this purpose. For high speed trigger pulses, SMB to SMA adapters are available from Gigatronics. CW triggering sets the power sensors to measure CW power: essentially, triggering is disabled. "CW" is automatically set by the 58542 during power sweep calibration; do not apply any triggering to the peak power sensor during power sweep calibration.

Be sure to set the trigger level, SENS:TRIG:LEV ##.# after the INTernal or EXTernal triggering is selected.

SENSe<sensor 1 or 2>:TRIGger:SOURce?
OUTPUT@Pwr_mtr;"SENS1:TRIG:SOUR?" ! Query sensor 1 peak trigger mode
Response is "INT", "EXT", or "CW".

DESCRIPTION

This command reports the current trigger source setting.

SENSe<sensor 1 or 2>:TRIGger:DELay[:MAGnitude]:*space* <delay in seconds from -20e-9 to 105e-3>
OUTPUT@Pwr_mtr;"SENS1:TRIG:DEL 1e-6" ! Set sensor 2 peak delay value to 1e-6 seconds

DESCRIPTION

The SENS:TRIG:DEL # is the amount of time in seconds between the 80350A Series Peak Power Sensor's receipt of a sensor trigger (INT is auto, EXT is a trigger input) and the time that the sampler is fired. This delay is typically accurate to about 0.5%; repeatability is an order of magnitude better. There is a delay line built into the peak power sensor. Therefore, you will be able to measure the power on the leading edge of the pulsed signal even if it's the same edge on which the sensor was triggered. This also allows limited "look ahead" capability as identified by the allowed negative time values for this command. The other reason negative time values are allowed is due to the sample delay offset capability. (The 80340 Series of Peak Power Sensors do not support this command.)

SENSe<sensor 1 or 2>:TRIGger:DELay[:MAGnitude]?
OUTPUT@Pwr_mtr;"SENS1:TRIG:DEL?" ! Query sensor 1 peak delay value
Response is Peak Sensor sample delay in seconds from -20e-9 to 105e-3.

DESCRIPTION

This query reports the current value of the peak power sensor sample delay.

SENSe<sensor 1 or 2>:TRIGger:DELay:STATe*space*<ON or OFF>
OUTPUT@Pwr_mtr;"SENS1:TRIG:DEL:STAT ON" ! Enable peak sensor 1 delay function

DESCRIPTION

This command activates the sample delay in the 80350A Series Peak Power Sensors. The 80340 Peak Power Sensors also respond to this command, but with only a fixed time delay.

SENSe<sensor 1 or 2>:TRIGger:DELay:STATe?
OUTPUT@Pwr_mtr;"SENS1:TRIG:DEL:STAT?" ! Query peak sensor 1 delay function
Response is a "1" or "0", for ON or OFF, respectively.

DESCRIPTION

This query is used to identify if the DELay:STATe is ON or OFF.

SENSe<sensor 1 or 2>:TRIGger:LEVel[:MAGnitude]*space*<In EXT triggering use -0.1 to 5.000V. In INT triggering use -30 to +20 dBm>
OUTPUT@Pwr_mtr;"SENS1:TRIG:LEV 1.7" ! Set peak sensor 1 trigger level to 1.7 volts

DESCRIPTION

This command sets the trigger level for the 80350A Series Peak Power Sensors. Under INTernal triggering the value is in dBm (-30 to +20 dBm, with default of -20 dBm) . When EXTernal triggering is used the value is in Volts (-0.100V to 5.000V, with a default of 1.700V). The trigger level must be lower than the signal that is triggering the peak power sensor. Under Internal triggering, this means that a -16 dBm signal must be triggered with a setting that is less than -16 dBm. EXT responds similarly. The input impedance to the EXT trigger port on the back of the sensor housing is not 50 ohms: it is a high impedance to prevent damage from triggering inputs such as 5.0V TTL signals. If you use a high

speed 50 ohm trigger source, this may cause unwanted signal reflections and noise on the trigger line. An SMB to SMB attenuator is available from Giga-tronics to alleviate this condition. The attenuation reduces the reflected noise, and reduces/eliminates the noisy trigger characteristics. (The 80340 Series Peak Power Sensors do not support this command.)

Be sure to set the trigger level after the INTernal or EXTernal triggering is selected.

SENSe<sensor 1 or 2>:TRIGger:LEVel[:MAGnitude]?
OUTPUT@Pwr_mtr;"SENS1:TRIG:LEV?" ! Query peak sensor 1 trigger level
Response is the current peak power sensor trigger level setting - a single value in Volts or dBm.

DESCRIPTION
This query reports the current trigger level setting. Under INTernal triggering the value is in dBm. When EXTernal triggering is used the value is in Volts.

SENSe<sensor 1 or 2>:TRIGger:OFFSet[:MAGnitude]
OUTPUT@Pwr_mtr;"SENS1:TRIG:OFFS 0" ! Set peak sensor 1 trigger offset time to 0 second

DESCRIPTION
This command sets the peak power sensor trigger offset time.
(The 80340 Series Power Sensors do not support this command.)

SENSe<sensor 1 or 2>:TRIGger:OFFSet[:MAGnitude]?
OUTPUT@Pwr_mtr;"SENS1:TRIG:OFFS?" ! Query peak sensor 1 trigger offset time
Response is the current peak power sensor trigger offset setting - a single value in seconds

DESCRIPTION
This query reports the peak power sensor trigger offset time.

SENSe<sensor 1 or 2>:TRIGger:TOTAl[:MAGnitude]?
OUTPUT@Pwr_mtr;"SENS1:TRIG:TOTA?" ! Query peak sensor 1 total trigger delay time
Response is the current peak power sensor total trigger delay setting - a single value in seconds

DESCRIPTION
This query reports the peak power sensor total trigger delay time

Averaging

SENSe:AVERage

Averaging is applied during normal operating mode. In the normal mode, Avg N results in N x 192 samples taken. In the Swift or Burst modes, Avg N results in 2^{N+1} samples taken. Auto averaging takes 4 samples all the time. For auto averaging in the normal mode, the averaging number is level dependent with very low averaging at +20 dBm, and many samples taken at very low levels.

SENSe<sensor 1 or 2>:AVERage:COUNt*space*<1,2,4,8,16,32,64,128,256,or 512>

```
OUTPUT @Pwr_mtr;"SENS1:AVER:COUN 16"          ! Set sensor 1 average number to 16
```

DESCRIPTION

This command averages successive sensor readings in a digital averaging filter. As the measured signal level approaches the noise floor of the power sensor, measurement data values begin to fluctuate. To measure very low signal levels (within a few dB of the sensor noise floor), set a large value for averaging such as 128, 256, or 512. Be sure to zero the sensor, CALibration:ZERO, prior to critical measurements.

SENSe<sensor 1 or 2>:AVERage:COUNt?

```
OUTPUT @Pwr_mtr;"SENS1:AVER:COUN?"            ! Query sensor 1 current averaging value
```

DESCRIPTION

This query returns the current averaging value of the 58542s' internal digital averaging filter.

SENSe<sensor 1 or 2>:AVERage:COUNt:AUTO*space*<ON or OFF>

```
OUTPUT @Pwr_mtr;"SENS2:AVER:COUN:AUTO ON"     ! Select sensor 2 Auto-Averaging mode
```

DESCRIPTION

Auto-Averaging automatically optimizes the measurement averaging value for reading stability and update rate when the measurement data is being repeatedly updated. At high power levels (measured), minimum averaging is applied to optimize measurement speed. As the power level drops, additional averaging is applied to steady the measured data reading.

SENSe<sensor 1 or 2>:AVERage:COUNt:AUTO?

```
OUTPUT @Pwr_mtr;"SENS2:AVER:COUN:AUTO?"     ! Query sensor 2 Auto-Averaging mode
                                            ! ON or OFF status
```

Response is "1" or "0"

DESCRIPTION

This query returns the ON or OFF status of the 58542s' Auto-Averaging.

SENSe<sensor 1 or 2>:AVERage:TCONtrol*space*<data acquisition averaging method, MOVing or REPeat>

```
OUTPUT @Pwr_mtr;"SENS1:AVER:TCON REP"       ! Set sensor 1 to acquire fresh
                                            ! measurement data before averaging
```

DESCRIPTION

The SENSe:AVERage:TCONtrol commands are instrument level commands that control the internal measurement data averaging of the 58542 VXI Power Meter. Two modes are selectable, MOVing and REPeat.

The MOVing control applies the current measurement to the previously measured data. That is, even if the averaging number is 16, you'll get a measurement data point every time a sample is taken, not just after every 16 samples. There is some limited built in level sensing capability. For example, when Auto-Averaging is used and the power is suddenly changed from a low value to a high, MOVing averaging throws out the very low level previous data as the gain range changes and begins averaging fresh data. Thus, wide abrupt changes in power level are not masked by the MOVing averaging. The 58542 can fully range in about 4 ms. MOVing averaging is similar to TR1 mode in typical benchtop power meters.

REPeat averaging performs full averaging every time the 58542 is triggered. Unless the averaging number is set to 1, REPeat is slower than MOVing averaging. REPeat control is similar to TR2 mode in typical benchtop power meters. Fresh data is measured and averaged with each complete measurement cycle.

SENSe<sensor 1 or 2>:AVERage:TCONtrol?

```
OUTPUT@Pwr_mtr;"SENS1:AVER:TCON?"           ! Query sensor 1 average method
```

Response is "REP" or "MOV" or "NOR"

DESCRIPTION

This query returns the average method chosen by the command form or the default.

Relative or Referenced Measurements

CALCulate:REFerence

Relative and referenced measurements are used when one measured value needs to be compared to another measured value on the same channel. For example, this function is used when it is desired to monitor the power level variation around an initial "turn on" or "reference set" value.

Referenced measurements are performed when finding the 1 dB compression power of an amplifier or using a return loss bridge. When a stable source is used, a relative measurement is useful for measuring the loss through an attenuator with a single sensor or channel.

Due to the ability to set a specific value of reference using the CALC:REF[:MAG] # command, this reference measurement function can also be used to set your own calibration factors. Thus the channel and sensor offset functions can remain dedicated to other setup dependent controls in your programming.

CALCulate<channel 1 or 2>:REFerence:STATE*space*<ON or OFF>

```
OUTPUT @Pwr_mtr;"CALC2:REF:STAT ON"        ! Activate level reference for relative
                                           ! measurements
```

DESCRIPTION

This command activates the 58542s' level reference capability. This gives the 58542 the ability to perform relative measurements.

CALCulate<channel 1 or 2>:REFerence:STATe?

```
OUTPUT @Pwr_mtr;"CALC2:REF:STAT?"          ! Query ON or OFF status
    Response is "0" = off;  "1" = on
```

DESCRIPTION

This query returns the ON or OFF status of the reference function.

CALCulate<channel 1 or 2>:REFerence [:MAGnitude] <dB Offset value form -299.999 to 299.999>

```
OUTPUT@Pwr_mtr;"CALC2:REF -30.11"          ! Set channel 2 reference offset value in dB
```

DESCRIPTION

This command sets the value to subtract from the channel measurement value. This command applies to the channel (1, or 2, or 1/2, ...), not the sensor (1 or 2, only).

CALCulate<channel 1 or 2>:REFerence [:MAGnitude]?
OUTPUT @Pwr_Mtr;"CALC1:REF?" ! Query channel reference value
Response is a single number reporting the reference value.

DESCRIPTION

This query reports the current value being subtracted from channel measurements.

CALCulate<channel 1 or 2>:REFerence:COLLect
OUTPUT @Pwr_mtr;"CALC2:REF:COLL" ! Current Rdg. ==> Ref level.
! Take channel 2 reading as reference value

DESCRIPTION

The CALCulate:REF erence:COLLect command will cause the level of the current power measurement to become the reference level. There is no query form of this command. After you send this command, the channel measurement will be zero - assuming the power levels at the sensor(s) didn't change and REF:STAT is ON.

EXAMPLE PROGRAMS

The following program automatically sets a power level reference when the computer's ENTER key is actuated. From that point forward the power level - relative to the the power level at the time the ENTER key was actuated - is monitored and displayed with minimum and maximum values since the reference was set.

```
290  ASSIGN @Pwr_mtr to 70101
300  CLEAR @Pwr_mtr
310  WAIT 1
320  !
330  OUTPUT @Pwr_mtr;"CALC1:MODE NORMAL"     ! Can ONLY use REFerence commands in NORMal
                                             ! Mode!!
340  OUTPUT @Pwr_mtr;"CALC2:POW 2"           ! Channel 2 configured to measure sensor 2 power
350  !
360  OUTPUT @Pwr_mtr;"TRIG:SOUR IMM"         ! TRIG:SOUR must be IMM when using READ#?
370  OUTPUT @Pwr_mtr;"INIT:CONT OFF"         ! INITiate:CONTinuous arming must be OFF when using
                                             ! READ#?
380  !
390  OUTPUT @Pwr_mtr;"SENS2:AVER:COUN 1"     ! Sets averaging to manual and one sample per
                                             ! measurement reading.
400  !
410  OUTPUT @Pwr_mtr;"SENS2:CORR:FREQ 17.4E9" ! Applies Cal Factor for 17.4 GHz to measurement data.
420  !
430  !#########################################################################3
440  !
450  ! Relative measurement setup using CALC#:REF:COLL.
460  !
470  OUTPUT @Pwr_mtr;"CALC2:REF:MAG 0.00"    ! Resets REFerence level from value set with
                                             ! CALC2:REF:COLL
```

```
480 OUTPUT @Pwr_mtr;"CALC2:REF:STAT ON"          ! Enables REFerence operation.
490 !
500 INPUT "Press ENTER key to set to 0.0 dB reference operation",Dmy
510 OUTPUT @Pwr_mtr;"CALC2:REF:COLL"             ! Takes current measurement and adds inverse to further
                                                 ! measurements
520 !
530 !   Setup power meters' MIN and MAX monitors
540 !
550 OUTPUT @Pwr_mtr;"CALC2:MIN:STAT ON"
560 OUTPUT @Pwr_mtr;"CALC2:MAX:STAT ON"
570 !
580 PRINT "Power Variation","Largest Min","Largest Max."
590 WHILE Cont_meas=1
600  OUTPUT @Pwr_mtr;"MEAS2?"                   ! Measures Power at sensor.
610  ENTER @Pwr_mtr;Rdg
620  !
630  OUTPUT @Pwr_mtr;"CALC2:MIN?"               ! Grabs minimum since CALC2:MIN:STAT ON
640  ENTER @Pwr_mtr;Min
650  OUTPUT @Pwr_mtr;"CALC2:MAX?"               ! Grabs maximum since CALC2:MAX:STAT ON
660  ENTER @Pwr_mtr;Max
670  PRINT Rdg,"",Min,"",Max
680  END WHILE
690 !
890 END
```

The following program finds the 1 dB compression of an amplifier/transmitter at a single frequency.

```
300 ASSIGN @Pwr_mtr to 70101
310 CLEAR @Pwr_mtr
320 WAIT 1
330  !
340 OUTPUT @Pwr_mtr;"CALC1:MODE NORMAL"          ! Can ONLY use REFerence commands in NORMal
                                                 ! Mode!!
350 OUTPUT @Pwr_mtr;"CALC1:POW 1"                ! Channel 1 configured to measure sensor 1 power
360 OUTPUT @Pwr_mtr;"CALC1:UNIT W"               ! Transmitter output power in Watts.
370 OUTPUT @Pwr_mtr;"CALC2:RAT 1,2"              ! Transmitter gain stays in default, dBm.
380 OUTPUT @Pwr_mtr;"CALC2:UNIT DBM"             ! Transmitter output power in Watts. Units are channel,
                                                 ! not sensor, specific.
390 !
400 !
410 OUTPUT @Pwr_mtr;"TRIG:SOUR IMM"              ! TRIG:SOUR must be IMM when using READ#?
420 OUTPUT @Pwr_mtr;"INIT:CONT OFF"              ! INITiate:CONTinuous arming must be OFF when using
                                                 ! READ#?
430 !
440 OUTPUT @Pwr_mtr;"SENS1:AVER:COUN 1"          ! Sets averaging to manual and one sample per
                                                 ! measurement reading.
450 OUTPUT @Pwr_mtr;"SENS2:AVER:COUN 4"          ! Sets averaging to manual and 4 samples per
                                                 ! measurement reading.
460 !
470 OUTPUT @Pwr_mtr;"SENS1:CORR:FREQ 1.94E9"     ! Applies Cal Factor for 1.94 GHz, Sensor 1.
480 OUTPUT @Pwr_mtr;"SENS2:CORR:FREQ 7.0E7"      ! Applies Cal Factor for 70 MHz IF input, Sensor 2.
490 !
```

```
500 !################################################
510 !
520 ! System Setup
530 !     Power Splitter attached to source.
540 !     DUT input and sensor 2 on the splitter outputs.
550 !     Sensor 1 at DUT output.
560 !          Check max power rating on sensor 1 and use an appropriate attenuator if necessary.
570 !          Use offset to account for any necessary attenuation when not using Giga-tronics high power sensors.
580 !
590 !#################################################################
600 !
610 ! Relative measurement setup using CALC#:REF:COLL.
620 !
630 OUTPUT @Pwr_mtr;"CALC2:REF:MAG 0.00"          ! Resets REFerence level from value set with
                                                  ! CALC2:REF:COLL
640 OUTPUT @Pwr_mtr;"CALC2:REF:STAT ON"          ! Enables REFerence operation.
650 !
660 Smal_sig_pwr=-30
670 OUTPUT @Source;"OPPL";Smal_sig_pwr            ! Set power to small signal region of amp, -30 dBm.
680 OUTPUT @Pwr_mtr;"CALC2:REF:COLL"              ! Takes current measurement and adds inverse to
                                                  ! further measurements
690 !
700 !   STEP POWER FROM SMALL SIGNAL REGION TO ABOVE 1 dB COMPRESSION LEVEL
710 !
720 FOR I=Smal_sig_pwr TO Smal_sig_pwr+40 STEP .05
730  OUTPUT @Source;"OPPL";I                      ! Increments power level into amplifier's input. Add
                                                  ! wait statement at 735 if source settles too slow.
740  OUTPUT @Pwr_mtr;"READ2?"                     ! Measures Sensor 1 over sensor 2, dB relationship
750  ENTER @Pwr_mtr;Rdg
760  PRINT Rdg
770  !
780  Comp_lvl=-1
790  IF Rdg<Comp_lvl THEN                         ! Finds 1 dB compression level
800   OUTPUT @Pwr_mtr;"READ1?"                    ! Measures Output Power at sensor 1.
810   ENTER @Pwr_mtr;Rdg
820   PRINT "1 dB Compression level is ";Rdg;"Watts, Output Power."
830   GOSUB End
840  END IF
850 NEXT I
860 !
1060 End:  !
1070 END
```

ERROR CONTROL

Selected basic SCPI syntax and execution error apply to these commands.

Device specific errors include the following and other -300 level errors.

Use CALC:REF commands only in the NORMal Mode. Attempts to use these commands in the SWIFt and BURSt modes will be ignored and the error , -300,"Device-specific error;Normal mode is off." will be generated.

Offsets

SENSe:CORRection

Sensor power offsets apply to the individual sensor. For example, use sensor offsets to account for the loss of attenuators which are commonly used during measurement to reduce standing waves - improving measurement accuracy. If you are measuring high power signals (>100 mW), but are not using Giga-tronics high power sensors, you will need to use a power attenuator between your high power output and the sensor input to prevent damage. Enter the value of attenuation as a sensor offset, and the 58542 will automatically respond with the actual power level output in its measurement data.

SENSe<sensor 1 or 2>:CORRection:OFFSet:COLLect

```
OUTPUT@Pwr_mtr;"SENS1:CORR:OFFS:COLL"        ! Take sensor 1 current reading as offset value
```

DESCRIPTION

This command enters the current power level reading as the offset value.

SENSe<sensor 1 or 2>:CORRection:OFFSet[:MAGnitude]*space***<offset value in dB, -99.99 to 99.99>**

```
OUTPUT @Pwr_Mtr;"SENS2:CORR:OFFS 10.2"       ! Compensate sensor 2  for 10.2 dB
                                             ! attenuation
```

DESCRIPTION

This command enters a specific sensor offset value.

SENSe<sensor 1 or 2>:CORRection:OFFSet[:MAGnitude]?

```
OUTPUT @Pwr_Mtr;"SENS2:CORR:OFFS?"           ! Query sensor 2 offset value
    Response is "0.0000E+00"                 ! for 0 dB
```

DESCRIPTION

This query reports the current dB value of the sensor offset which is being subtracted from measurements.

SENSe<sensor 1 or 2>:CORRection:OFFSet:STATe*space***<ON or OFF>**

```
OUTPUT @Pwr_Mtr;"SENS2:CORR:STAT ON"         ! Enable sensor 2 offset correction
```

DESCRIPTION

This command activates and deactivates the sensor offset function.

SENSe<sensor 1 or 2>:CORRection:OFFSet:STATe?

OUTPUT @Pwr_Mtr;"SENS2:CORR:STAT?" ! Query sensor 2 offset function status

Response is "1" or "0" for ON or OFF, respectively.

DESCRIPTION

This query reports the ON or OFF status of the sensor offset function.

SRQ & Status Monitoring

***CLS**
***ESE**
***ESR?**
***OPC and *OPC?**
***SRE**
STATus:OPERation
STATus:PREset
***STB?**

***CLS**

```
OUTPUT @Pwr_mtr:"*CLS"                    ! Clear srq and status byte registers
```

DESCRIPTION

The *CLS command is the clear status command defined by IEEE 488.2. This command clears all of the status bytes to the value, 0. After a service request interrupt is transmitted from the 58542 to the controller, use the *STB command to read the status byte from the 58542. Then reset the srq and use *CLS clear status command to reset the numeric status indication of the status byte/registers to 0 (all bits will be 0).

*CLS does not affect the enabled or disabled status of the status byte/register's masks. For example, if you have bit 8 of the operation register enabled before sending *CLS, it will remain enabled afterward. *CLS also clears the output queue (takes 0.3 sec to complete this function).

***ESE**

ESE*space*<event status register value, 0 to 255>

```
OUTPUT @Pwr_Mtr;"*ESE 16"                 ! Enable bit 4 of event status register  mask
```

DESCRIPTION

This comand sets/clears the event status register enable mask.

***ESE?**

```
OUTPUT @Pwr_Mtr;"*ESE?"                   ! Query currently enabled bits of
                                          ! event status register mask
```

Response is "Sum of the bits set in the event status enable register"

DESCRIPTION

This query returns the mask of the event status register.

*ESR?

```
OUTPUT @Pwr_Mtr;"*ESR?"          ! Return event status register value
```

DESCRIPTION

This query returns the current status register value.

*OPC and *OPC?

```
OUTPUT @Pwr_mtr;"*OPC"           ! *OPC allows one time srq enable
OUTPUT @Pwr_mtr;"*OPC?"          ! send a "1" upon operation complete
```

DESCRIPTION

The *OPC command is used to determine when an operation is completed. This command is generally used to monitor the completion of long measurement sequences. It sets the operation complete bit in the event status register upon completion of operation. The query form, *OPC?, automatically returns a "1" or "0" flag.

*SRE

*SRE*space*<event status register value, 128, 64, 32,16,8,4,2,1 >

```
OUTPUT @Pwr_mtr;"*SRE 32"        ! Enable bit 5 of Status Byte register
```

DESCRIPTION

This command sets the mask of the Status Byte register.

*SRE?

```
OUTPUT @Pwr_mtr;"*SRE?"          ! Query Bits Enabled of Status Byte register
  Response is the status register mask value
```

DESCRIPTION

This query returns the mask of the Status Byte register.

STAT:OPER

STATus:OPERation[:EVENt]?

```
OUTPUT@Pwr_mtr;"STAT:OPER?"      ! Query operation event register result
```

DESCRIPTION

This query returns the operation event register result.

STAT:PRES

STATus:PRESet

```
OUTPUT @Pwr_mtr;"STAT:PRES"          ! Clears all the status register value
```

DESCRIPTION

This command clears all status registers.

*STB?

```
OUTPUT @Pwr_mtr:"*STB?"              ! Query status byte register
```

DESCRIPTION

This query returns status byte register result.

The SCPI status reporting structure includes the IEEE-488.2 Status Registers. Please note that bit 5 of the OPERation Status Register is only used during BURSt and SWIFt modes. NORMal mode does not use this function.

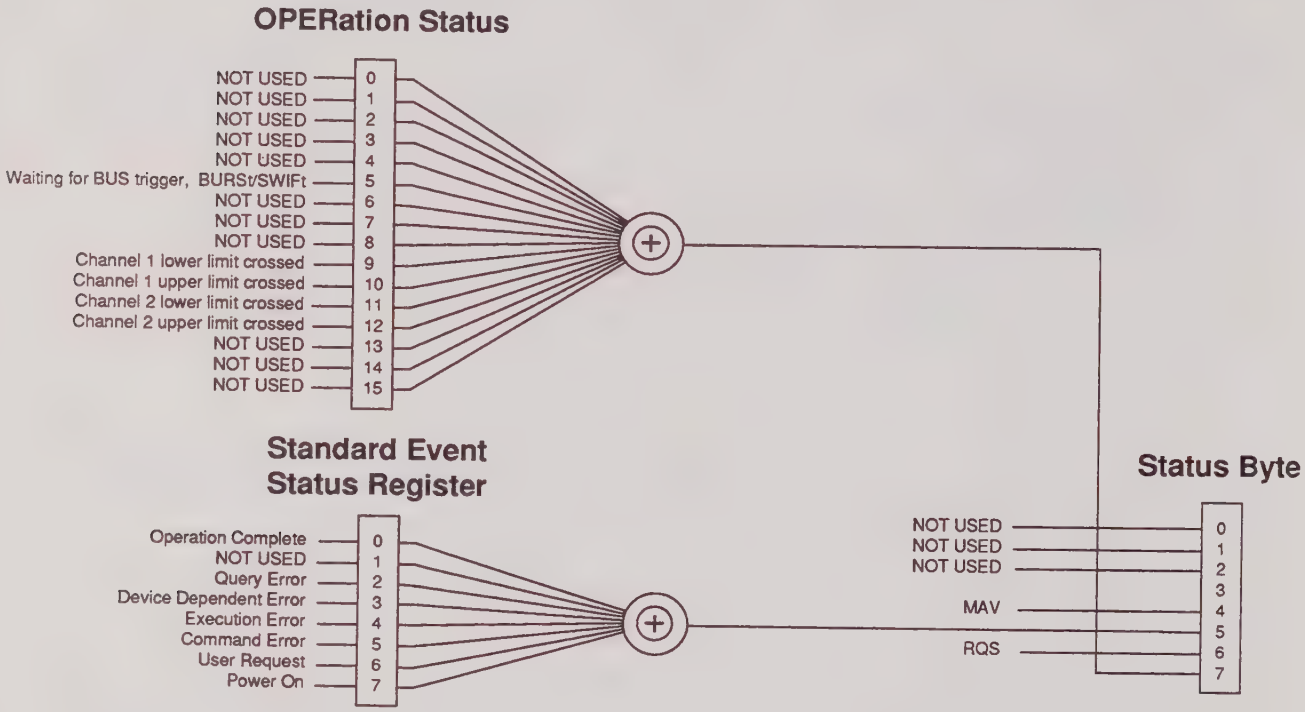


Figure 3-6. SCPI Status Structure Registers

Event Status Register

The *ESE command is used in combination with group commands that form the 58542s' service request system. These commands and their responses are almost identical to the IEEE-488 (GPIB) srq service request command structures. The *ESE command is used to enable bits of the event status register mask.

The *ESE command is one of the commands you can use to monitor the status of the power meter. Together with the status byte (also see commands *STB? or *SRE?) and the operation status register (STATus:OPERation), the event status register provides information on several critical 58542 functions and error conditions.

Table 3-D. Event Status Register Description and Logical Values.

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Power On	0	Command Error	Execution Error	Device Dependent Error	0	0	Operation Complete
Value= 128	Value= 64	Value= 32	Value= 16	Value= 8	Value= 4	Value= 2	Value= 1

NOTE: The "Value" in the above table is used both to enable a bit's event function, and to enable that bit of the event status register mask to report the event status (following the *ESR? command).

The event status register is 8 bits long and is structured according to the following table.

As shown in Table 3-D, bits 1, 2, and 6 are not used. When bit 3 is a "1", a device dependent error has occurred. When bit 4 is a "1", an execution error has occurred. When bit 5 is a "1", a command error has occurred. Bit 7 is a "1" when the 58542 is turned ON. The 58542 does not have a standby mode; therefore, it is probably not useful to enable bit 7 of the event status register mask (by sending the command *ESE 128).

In the default state, the 58542s' event status register is masked, or set to off. None of the bits are enabled. For example, if an execution error occurs, a service request will not be sent to the controller and the event status register will remain set to "0". The *ESE command is used to enable each particular bit. These bits must be enabled individually. They can be cleared, or turned off as a group, by sending the *CLS command.

To use the event status register, the bit 5 of the status byte must also be enabled by sending the command *SRE 32.

*ESE? reports the enabled settings of the event status register mask. The *ESR? query returns the current value of the event status register.

NOTE: A Functional Description of the service request system can be found under "*SRE" in the "IEEE Standard Codes, Formats, Protocols, and Common Commands (ANSI/IEEE Std 488.2-1987)" publication (Section 10.34, located on page 111 of the publication).

Table 3-E. Status Byte

Bit	7	6	5	4	3	2	1	0
Weight	128	64	32	16	8	4	2	1
Service Request Condition	Operational Status	RQS bit Require Service	Event Status	Message Available	0	0	0	0

NOTES:
The condition indicated in bits 1 - 5 must be enabled by the Service Request Mask to cause a Service Request Condition. The mask is set with the "*SRE" program code followed by ASCII characters. The value of the byte is determined by summing the weight of each bit to be checked.

The RQS (bit 6) is true when any of the conditions of bits 4, 5, and 7 are enabled and occur. Bits remain set until the Status Byte is cleared.

SRQ Interrupt Sample Program

```
10    ASSIGN @Pwr_mtr to 70101                    ! Set GPIB address
20    DIM Buf$[100]                               ! Define data buffer
30    ON INTR 7 GOSUB Srq_isp                     ! Assign interrupt service function
40    ENABLE INTR 7;2                             ! enable interrupt
50    !
60    CLEAR @Pwr_mtr                              ! Reset instrument
70    WAIT 1
80    OUTPUT @Pwr_mtr,"*CLS"                      ! Clear interface and output queue
90    WAIT 0.3
100   !
110   OUTPUT @Pwr_mtr;"*ESE 1"                    ! Enable OPC bit
120   OUTPUT @Pwr_mtr;"STAT:OPER:ENAB 7712"       ! Enable channel 1 & 2 limit and trigger wait mask
130   !
140   Srq_flag=0                                  ! Reset task done flag
150   OUTPUT @Pwr_mtr;"CAL1:ZERO?;*OPC"           ! Zero sensor 1
160   WHILE Srq_flag = 0                          ! Wait until it is done
170       END WHILE
180   ENTER @Pwr_mtr;Result                       ! Read zero result
190   IF Result = 0 THEN PRINT "Zero is good"
200       ELSE
210       PRINT "Zero is no good"
220       END IF
230   ENTER @Pwr_mtr;Esr_val                      ! Read ESR status
240   !
250   Srq_flag = 0                                ! Reset task done flag
260   Meas_flag = 0                               ! Reset measurement flag
270   OUTPUT @Pwr_mtr;"MEAS1?;*OPC"               ! Measure channel 1 data
280   WHILE Srq_flag = 0                          ! Wait until it is done
290       END WHILE
300   IF Meas_flag = 0 THEN                       ! If data is not read
310       ENTER @Pwr_mtr;Result                   ! Read measurement data
320       END IF
330   ENTER @Pwr_mtr;Esr_val                      ! Read ESR status
340   !
350   STOP
360   !
370   Srq_isp:!
380       State = SPOLL(@Pwr_mtr)                 ! Serial poll
390   !
400       IF BIT(State,3) THEN                    ! Error bit
410           OUTPUT @Pwr_mtr;"SYST:ERR?"         ! Query error message
420           ENTER @Pwr_mtr;Buf$                 ! Read in
430           PRINT "Error:";Buf$                 ! Print out message
440           END IF
450   !
460   IF BIT(State,7) THEN                        ! OSB bit
470   !
480       IF BIT(State,4) THEN                    ! MAV bit
490           ENTER @Pwr_mtr;Result               ! Query measurement data
500           Meas_flag = 1                       ! Set data read flag
510           END IF
520   !
```

```
530       OUTPUT @Pwr_mtr;"STAT:OPER?"                    ! Query operation status register
540       ENTER @Pwr_mtr;Status
550       PRINT "OSB";Status
560       IF BIT(Status,5) THEN PRINT "Swift/Burst trigger ready"
570       IF BIT(Status,8) THEN PRINT "Channel 1 lower limit"
580       IF BIT(Status,9) THEN PRINT "Channel 1 upper limit"
590       IF BIT(Status,10) THEN PRINT "Channel 2 lower limit"
600       IF BIT(Status,11) THEN PRINT "Channel 2 upper limit"
610       END IF
620  !
630  IF BIT(State,5) THEN                                 ! ESR bit
640       OUTPUT @Pwr_mtr;"*ESR?"                         ! Reset event status register
650       END IF
660  !
670  Srq_flag = 1                                         ! Set task done flag
680  ENABLE INTR 7;2
690  RETURN
860  END
```

Min/Max Configuration & Monitoring

CALCulate:MAXimum
CALCulate:MINimum

MIN and MAX channel monitoring is used to record the minimum and maximum variation of channel amplitude over time. Time zero is set by setting the MIN or MAX STATe to "ON". The default Preset and turn on configuration is "ON". After setting to "ON", the minimum and maximum value of the measured value on that channel will be recorded. To reset the MIN and MAX value back to the current value, you only need to set the STATe to ON again. The "STAT OFF" does not need to be sent during reset of MIN and MAX values. Individual sensor minimum and maximum power level variations can be monitored only if that sensor is defined directly to a channel with "POW 1" or "POW 2".

MIN and MAX channel monitoring is only available in Normal Mode. BURSt and SWIFt modes do not perform MIN and MAX monitoring.

CALC:MAX

CALCulate<channel 1 or 2>:MAXimum:STATE*space*<ON or OFF>
OUTPUT@Pwr_mtr;"CALC2:MAX:STAT ON" ! Enable channel 2 maximum tracking

DESCRIPTION
"ON" activates the MAX monitoring function. The maximum value of the channel (not sensor) is monitored until the value is reset by "CALC#:MAX:STAT ON" or "CALC#:MAX:STAT OFF" is sent.

CALCulate<channel 1 or 2>:MAXimum:STATe?
OUTPUT@Pwr_mtr;"CALC2:MAX:STAT?" ! Query channel 2 maximum mode
Response is a "1" or "0", for ON or OFF, respectively.

DESCRIPTION
Reports ON or OFF status of MAX monitoring.

CALCulate<channel 1 or 2>:MAXimum[:MAGnitude]?
OUTPUT@Pwr_mtr;"CALC2:MAX?" ! Query channel 2 maximum value in dBm
Response is highest power reading since "CALC2:MAX:STAT ON" was sent.

DESCRIPTION
This command will report the value maintained as the maximum in the 58542 max monitor.

CALC:MIN

CALCulate<channel 1 or 2>:MINimum:STATE*space*ON OFF

```
OUTPUT@Pwr_mtr;"CALC1:MIN:STAT ON"          ! Enable channel 1 minimum tracking
```

DESCRIPTION

This command is used to activate the miminum channel value monitor.

CALCulate<channel 1 or 2:MINimum:STATe?

```
OUTPUT@Pwr_mtr;"CALC1:MIN:STAT?"            ! Query channel 1 minimum mode
```

Response is a "1" or "0", for ON or OFF, respectively.

DESCRIPTION

This command is used to query the activation or deactivation of the minimum channel value monitor.

CALCulate<channel 1 or 2>:MINimum [:MAGnitude]?

```
OUTPUT@Pwr_mtr;"CALC1:MIN?"                 ! Query channel minimum value in dBm
```

Response is lowest power reading since "CALC2:MIN:STAT ON" was sent.

DESCRIPTION

This command will report the value maintained as the minimum in the 58542 min monitor.

Limit Line Configuration & Monitoring

CALCulate:LIMit

The CALCulate:LIMit commands are used to specify and query the status of power measurement limit values and limit line pass/fail checking. This allows the 58542 to monitor measured values and determine if the values are outside certain limits or above/below a single limit. The upper limit cannot be specified any lower than the lower limit; meaning that an exclusion zone of values cannot be specified.

Limit values can be specified separately for either of the two software calculation channels - 1 and 2. These channels can be specified to correspond to power sensors 1 and 2 (default) or as a combination of the power sensors. For example, set limit lines to monitor overload or under range conditions on an amplifier's output power and gain by specifying channel 1 as sensor 1 limits checking and channel 2 as Sensor 2/Sensor 1. Power sensor assignments to channel measurement definition is also part of the CALCulate Subsystem. Limit monitoring can not be performed for individual sensors unless a channel is configured for single sensor, "POW 1" or "POW 2" operation.

Upper and Lower limits can be active simultaneously.

Unless serial requests are enabled, the CALculate:LIMit commands can not be configured to automatically alert the controller directly during a limit violation; the 58542 must be queried to receive information regarding pass/fail status of limit line violations.

Automatic notification of limit line violations is accomplished using the status byte and the operation register. A controller can be notified of a limit line violation via the request service, *SRE command. After the controller receives the request service, query the event status register. Check the status register for a limit line violation or send CALCulate:LIMit:FAIL? to check if a limit line is being or has been violated. "1" indicates a limit line violation. "0" indicates the channel measurement is within the limit lines.

CALC:LIM

CALCulate<channel 1 or 2>:LIMit:CLEar[:IMMediate]

```
OUTPUT @Pwr_mtr;"CALC1:LIM:CLE"          ! Reset channel 1 limit violation indicator to "0"
```

DESCRIPTION

This command will reset the limit line pass/fail indicator to "0".

CALCulate<channel 1 or 2>:LIMit:FCOunt?
OUTPUT@Pwr_mtr;"CALC1:LIM:FCO?" ! Query number of channel 1 limit failures
Response is a single number - the number of times the limit lines were exceeded.

DESCRIPTION

This command will report the number of times a limit line has been exceeded since the limit checking function was set to ON, or the limit line monitor was cleared with CALC#:LIM:CLE.

CALCulate<channel 1 or 2>:LIMit:FAIL?
OUTPUT @Pwr_mtr;"CALC1:LIM:FAIL?" ! Check for channel 1 limit line violation
Response is t "0" = OK; "1" = fail

DESCRIPTION

This command will report whether or not a limit line has been exceeded since the limit checking function was set to ON, or the limit line monitor was cleared with CALC#:LIM:CLE.

CALCulate<channel 1 or 2>:LIMit:LOWer*space*<numeric value in dB from -299.99 to 299.99>
OUTPUT @Pwr_mtr;"CALC1:LIM:LOW -50.0" ! Set channel 1 lower limit line to -50 dBm

DESCRIPTION

This command specifies the lower limit line power level. The value should allow for any offset values currently in use. The default value is -299.99 dB or dBm.

CALCulate<channel 1 or 2>:LIMit:LOWer?
OUTPUT @Pwr_mtr;"CALC1:LIM:LOW?" ! Query channel 1 lower limit line setting
Response is a single number - the lower limit setting.

DESCRIPTION

This command queries the value of the lower limit line.

CALCulate<channel 1 or 2>:LIMit:STATe*space*<ON or OFF>
OUTPUT @Pwr_mtr;"CALC1:LIM:STAT ON" ! Enable channel 1 upper and lower limit
Response is "0" = off; "1" = on ! checking.

DESCRIPTION

This command activates and deactivates the limit line checking. The default condition is OFF.

CALCulate<channel 1 or 2>:LIMit:STATe?
OUTPUT @Pwr_mtr;"CALC1:LIM:STAT?" ! Query channel 1 ON or OFF status
Response is a "1" or "0", for ON or OFF, respectively.

DESCRIPTION

This command will report the activated or deactivated status of limit line checking.

CALCulate<channel 1 or 2>:LIMit:UPPer*space*<numeric value in dBm or dB from -299.99 to 299.99>
OUTPUT @Pwr_mtr;"CALC1:LIM:UPP 17.0" ! Set channel 1 upper limit line to 17 dBm

DESCRIPTION

This command specifies the upper limit line power level. The value should allow for any offset values currently in use. The default value is 299.99 dB or dBm.

CALCulate<channel 1 or 2>:LIMit:UPPer?
OUTPUT @Pwr_mtr;"CALC1:LIM:UPP?" ! Query channel 1 upper limit line setting
Response is a single value in dBm or dB, the upper limit line value

DESCRIPTION

This query returns the value of the upper limit line.

Analog Output

MEMory:CHANnel
MEMory:POWer
MEMory:UNIT
MEMory:VOLTage
OUTPut:ANAlog

The "ANALOG OUT" BNC connector on the front panel can be configured to output a voltage that corresponds to the power levels on one of the channels. This is useful for for applications such as source leveling or printing to a chart recorder.

The Analog Output operates only in NORMal Mode. It is automatically deactivated during SWIFt or BURSt modes, and comes back when operation is returned to the NORMal Mode.

MEM:CHAN

MEMory[:TABLe]:CHANnel*space*<channel 1 or 2>

```
OUTPUT@Pwr_mtr;"MEM:CHAN 2"          ! Set analog out to channel 2
```

DESCRIPTION

This command selects which channel will be present on the analog output connector.

MEMory[:TABLe]:CHANnel?

```
OUTPUT@Pwr_mtr;"MEM:CHAN?"           ! Query analog out channel number
```

Response is channel "1" or channel "2".

DESCRIPTION

This query reports which channel will be present on the analog output connector.

MEMory[:TABLe]:SELect*space*<ANALOGout,VPROPF1,VPROPF2>

```
OUTPUT@Pwr_mtr;"MEM:SEL VPROPF1"     ! Select memory table VPROPF1
                                     ! for editing in following lines
```

DESCRIPTION

This command selects between one of three editable tables. Using the 58542s' Analog Output capability requires you to configure the numerically linear power measurement to voltage output relationship by defining the corresponding end points of power and voltage.

MEMory[:TABLe]:SELect?

```
OUTPUT@Pwr_mtr;"MEM:SEL?"            ! Query selected memory table
```

Response is the table currently editable: ANALOG, VPROPF1, or VPROPF2.

DESCRIPTION

This query reports the currently editable table in the 58542.

MEMory[:TABLe]:UNIT*space***<choice of units DBM or Watt>**
OUTPUT@Pwr_mtr;"MEM:UNIT DBM" ! Set analog out power unit

DESCRIPTION

This command selects between one of two configurations, log units or linear units. In either case the voltage output will be numerically linear. Be sure to set the units control properly (dBm or W) before trying to set the numeric values.

MEMory[:TABLe]:UNIT?
OUTPUT@Pwr_mtr;"MEM:TABL:UNIT?" ! Query analog out power unit
Response is the units used for analog output configuration, DBM or W.

DESCRIPTION

This query reports the units for a channel analog output configuration.

MEMory[:TABLe]:POWer*space***<start value from -80 to +20 dBm>***comma***<stop value from -80 to +20 dBm>**
OUTPUT@Pwr_mtr;"MEM:POW -70,20" ! Set analog out power range (in dBm)
! from -70 to 20 dBm

DESCRIPTION

If log units are selected for analog output control, this command selects the beginning and end points of the power levels which will be assigned corresponding voltages at the analog output.

OUTPUT@Pwr_mtr;"MEM:POW?" ! Query analog out power range
Response is two dBm values separated by a comma indicating analog output range.

DESCRIPTION

This query reports the beginning and end points of the power levels selected to specify the analog output voltage.

MEMory[:TABLe]:POWer*space***<start value from 0 to 0.01W>***comma***<stop value from 0 to 0.01W>**
OUTPUT@Pwr_mtr;"MEM:POW 0,1e2" ! Set analog out power range (in Watts)
! from 0 to 0.01 Watts

DESCRIPTION

If linear units are selected for analog output control, this command selects the beginning and end points of the power levels which will be assigned corresponding voltages at the analog output. Also see MEM:VOLT on the next page.

MEMory[:TABLe]:POWer?
OUTPUT@Pwr_mtr;"MEM:POW?" ! Query analog out power range
Response is two Watt values separated by a comma indicating analog output range.

DESCRIPTION

This query reports the end points of power levels of the analog output configuration. When log units are selected, the units are dB or dBm. When linear units are selected the units are Watts.

MEM:VOLT

MEMory[:TABLe]:VOLTage*space*<**start value from -10 to +10V**>*comma*<**stop value from -10 to +10V**>
OUTPUT@Pwr_mtr;"MEM:VOLT -7,2" ! Set analog out voltage range from
! -8 to 2 volts corresponding to power

DESCRIPTION

This command is not units dependent. It selects the beginning and end points of the voltage levels which you desire to be present at the analog output. These voltages correspond to the power end points that are defined with either MEM:VOLT or MEM:POW.

MEMory[:TABLe]:VOLTage?
OUTPUT@Pwr_mtr;"MEM:VOLT?" ! Query analog out voltage range
Response is two voltage values separated by a comma indicating analog output range.

DESCRIPTION

This query reports the end points of the voltages configured for analog output operation.

OUTP:ANA

OUTPut[:BNC]:ANAlog[:STATe]*space*<**ON or OFF**>
OUTPUT@Pwr_mtr;OUTP:ANA ON" ! Enable analog out function

DESCRIPTION

This command activates and deactivates the analog output. The analog output will not operate unless this control is set to ON.

OUTPut[:BNC]:ANAlog[:STATe]?
OUTPUT@Pwr_mtr;OUTP:ANA?" ! Query analog out function status
Response is a "1" or "0", for ON or OFF, respectively.

DESCRIPTION

This query reports the "ON" or "OFF" status of the analog output.

Saving & Recalling Configurations

*RCL
*SAV

The 58542 has 21 instrument state memory registers. Registers 1 through 20 are available for store and recall. Register 0 contains the previous state of the instrument and can be used to toggle between two different instrument configuration states.

Instrument configuration can be saved to registers 1 through 20. ***CAUTION: Any configuration items which are not listed under the *RST or PRESet conditions are not saveable.*** Make sure all aspects of your configuration are saveable. For example, sensor power sweep calibration curves can not be saved in the configuration memory registers. Sensors must be calibrated to the 58542 power meter each time a new sensor is attached.

RCLspace*<memory location number, 0 to 20>

```
OUTPUT @Pwr_mtr;"*RCL 19"          ! Recall 58542 register 19
```

DESCRIPTION

Recalls instrument configuration. 0 is the PRESet configuration.

SAVespace*<memory location number, 1 to 20>

```
OUTPUT @Pwr_mtr;"*SAV 20"          ! Save at 58542 register 20
```

DESCRIPTION

Saves current configuration to memory. You cannot save a configuration to memory position 0.

Halting Operation

ABORt

```
ABORt
    OUTPUT @Pwr_mtr;"ABOR"                    ! Halts measurement & triggering
```

DESCRIPTION

This command stops operation, but it does not interrupt the completion of the current action. For example, sensor calibration is not interrupted. Burst mode data collection is not interrupted.

Preset Configuration

*RST
STATus:PRESet
SYSTem:PRESet

***RST**

```
OUTPUT @Pwr_mtr;"*RST"          ! Reset 58542 configuration
```

DESCRIPTION

This command resets the 58542 configuration to a known condition. See the table on the following page. Please note that these are not the power ON conditions. The 58542 has an internal battery which powers a non-volatile memory chip to remember configuration information. The only configuration that will change between power OFF and power ON is noted at the end of the table.

STATus:PRESet

```
OUTPUT @Pwr_mtr;"STAT:PRES"     ! Clears all the status register value
```

DESCRIPTION

This command resets the 58542 configuration to a known condition. See the table on the following page. Please note that these are not the power ON conditions.

SYSTem:PRESet

```
OUTPUT @Pwr_mtr;"SYST:PRES"     ! Reset 58542 configuration
```

DESCRIPTION

This command resets the 58542 Status information buffers. SYST:PRES is identical in function to *RST.

Model 58542 Power Meter Reset and Power On Default GPIB Command Configurations

RESET: (*RST)

Command	Default	Minimum	Maximum
CALCulate1[:CHANnel]: CALCulate2[:CHANnel]:	POWer 1 POWer 2		
CALCulate1-2:			
LIMit			
STATe OFF			
UPPer	299.999	-299.999	299.999
LOWer	-299.999	-299.999	299.999
FAIL?	0		
FCOunt?	0		
MAXimum:			
STATe	OFF		
[MAGnitude]	299.999	-299.999	299.999
MINimum:			
STATe OFF			
[MAGnitude]	-299.99	-299.99	299.99
MODE	NORmal		
REFerence:			
STATe	OFF		
[MAGnitude]	0	-299.99	299.99
STATe	ON		
UNIT	DBM		
INITiate:CONTinuous	OFF		
MEASure1-2[:SCALar:POWer]	With Auto average on		
MEMory[:TABLe]:			
CHANnel	1	1	2
FREQuency	0	0	40e9
POWer	-80,20	-80,-80	20,20
SELect ANALOGout			
SLOPe	0	0	10e9
VOLTage	-10,10	-10,-10	10,10
UNIT	DBM		

Command	Default	Minimum	Maximum
OUTput:			
ROSCillator[:STATe]	OFF		
[BNC:]ANALog[:STATe]	OFF		
SENSe1-2:			
AVERage:			
COUNt:	1	1	512
AUTO	ON		
TCONtrol	MOVing		
CORRection:			
FREQ	5e7	0	4e10
OFFset:			
STATe	OFF		
[MAGnitude]	0	-99.999	99.999
VPROpf[:STATe]	OFF		
TRIGger:			
DELay:			
STATe	OFF		
[MAGnitude]	1e-6	-5e-8	104e-3
LEVel (if INT trig)	-20.0	-30.0	20.0
LEVel (if EXT trig)	1.7	0.1	5.000
SOURce	IMMediate		
TRIGger:			
COUNt	1	0	128000
DELay	0.000	0.000	5.000
MODE	POST		
SOURce	IMMediate		
UNIT1-2[:POWer]	DBM		

POWER ON will override the internal battery back up memory and reset only the following configuration items as shown below. All other configuration items will remain the same as was true before power OFF.

CALCulate1-2:MODE	NORMal		
INITiate:CONTinuous	OFF		
MEMory[:TABLe]:SELect	ANALOGout		
OUTput:ROSCillator[:STATe]	OFF		
TRIGger:			
COUNt	1	0	128000
DELay	0.000	0.000	5.000
MODE	POST		
SOURce	IMMediate		

Instrument & Sensor Identification Commands

*IDN
SENSe:CORRection:EEPROM:TYPE
SYSTem:VERSion

The identification commands ensure that the instrument and sensor installed are appropriate for your test program. The sensor identification commands allow you to monitor what model of sensor is attached and ensure that the sensor has been properly calibrated to the power meter.

*IDN?

```
OUTPUT @Pwr_Mtr;"*IDN?"                                    ! Query inst. mfgr & model #
```

Response is **"Giga-tronics,58542,0,1.09"** where 1.09 is software version

DESCRIPTION

The *IDN? is the identify query command defined by IEEE 488.2. Upon receipt of this command, the 58542 VXI Power Meter will output a string that identifies itself as the Giga-tronics 58542 and indicates the firmware version number.

SENS:CORR:EEPROM:TYPE

```
SENSe<sensor 1 or 2>:CORRection:EEPROM:TYPE?
    OUTPUT@Pwr_mtr;"SENS1:CORR:EEPROM:TYPE?"               ! Query sensor 1 eeprom type
```

Response is **"80301,1818436"** which is model number and serial number respectively

DESCRIPTION

This command returns sensor model and serial number information.

SYST:VERS

```
SYSTem:VERSion?
    OUTPUT @Pwr_mtr;"SYST:VERS?"                           ! Query SCPI version
```

Response is **"1990.0"**

DESCRIPTION

This query returns the complied SCPI version.

EXAMPLE PROGRAMS

Instrument Identification

The following example reads manufacturer identification, model number and software version number. Software version number is important for trouble shooting and factory technical support. Make sure you or your system users can identify the software version when requesting technical support.

```
10   ALPHA ON
20   DIM Id$[60],Mfgr$[12]
        ! FOR INSTRUMENT ID VIEWING AT START UP
30      !
40   CLEAR SCREEN
50      !
60   !################################################
70      ! Instrument ADDRESS ALLOCATION
80      !
90   ASSIGN @Slot0 TO 70100
        ! 70200 is Logical Address of the Slot 0 controller
100  ASSIGN @Pwr_mtr TO 70101
        ! Default Power Meter Address of 255 allows VXI dynamic address
110     ! configuration
120     !
130  !################################################
140     !
150  OUTPUT @Slot0;"*IDN?"
160  ENTER @Slot0;Id$
170  PRINT "SLOT 0 is ";Id$
180     !
190  OUTPUT @Pwr_mtr;"*IDN?"
200  ENTER @Pwr_mtr;Mfgr$,Model,No,Software_ver
        ! DIM Mfgr$ to 12 characters
210  PRINT "A ";Mfgr$;" model";Model;"with software
        version";Software_ver;"is installed in slot 1."
211     !
212     ! Main Measurement Loop Start.
```

Instrument identification can be read as a single string as is done in lines 150 to 170 above. Sometimes, however, it is more convenient to read these four items separately for use in comment statements or as identifiers for selecting special command libraries or subroutines.

A simple method of separating the manufacturer sub-string from the three following numeric items requires you to read the manufacturer "alphabetical letters" into a string variable of limited size. Use a DIM or a REDIM statement to limit size to 12 characters. Thus, Model and Software Version can easily be read into numeric variables. "No" is always "0" ; it is placed in the *IDN? command output as called for by the IEEE 488.2 Standard. The 58542 can not report it's serial number - which is printed on a label positioned on the side of the instrument - over the bus. If preferred, there is space on the 58542's front panel for the serial number label. The factory will place it there upon request.

Sensor Model Identification

The following example reads the model number and serial number of the power sensor "currently in use." What does "currently in use" mean? It means that this was the last sensor connected to this meter input. It does not mean that the sensor is currently attached or that the sensor is calibrated. For in-program checking for sensor attachment or completed power sweep calibration, see the Error Control Examples on page 3-26 of the "Sensor Calibration and Zeroing" section or on page 3-41 of the "Reading Power Measurements" section. By operating in this manner, you can use a simple WHILE/UNTIL loop in your program to detect when the operator connects the correct power sensor.

Tracking the model number allows you to be sure that a sensor is being used which is appropriate for your measurement application. For example, some of your measurement routines may require the use of Peak Power Sensors rather than CW Power Sensor or use of high power sensors rather than standard sensors. Your program can automatically check for the appropriate sensor and prompt the operator to "Please connect Giga-tronics Sensor model #####", if necessary.

```
240       !
250   GOSUB Pwr_amp_test
260       !
270   GOSUB Store_results
280       !
290   END LOOP                                  ! Return to beginning of main program.
300       !
310   Pwr_amp_test:                             ! Output is 30 to 40 Watts, TOO HIGH for Standard Sensors
320       !
330   Reqd_snsr1_mdl=80355
          ! Actual 50W Peak Power Sensor model is 80355A.
340       ! The "A" is ignored in Gigatronics software to simplify programs like
          ! this one.
350   Reqd_snsr2_mdl=80350                      ! Standard 80350A Peak Power Sensor on input
360       !
370       !
380
!###############################################################
390       !
400       ! Read and compare sensors for correct model number
410       !
420   OUTPUT @Pwr_mtr;"SENS1:CORR:EEPROM:TYPE?"
          ! responds with model and serial numbers
430   ENTER @Pwr_mtr;New_snsr1_model,New_snsr1_serno
440   OUTPUT @Pwr_mtr;"SENS1:CORR:EEPROM:TYPE?"
          ! responds with model and serial numbers
450   ENTER @Pwr_mtr;New_snsr1_model,New_snsr1_serno
460       !
470   IF Reqd_snsr1_mdl=New_snsr1_model THEN
480   ELSE
490   PRINT "The amplifier's high power output must be attenuated for this test.",
500   PRINT "Connect a Gigatronics model";Reqd_snsr1_mdl;"to the channel 1 power sensor cable.",
510   INPUT "Then press ENTER",Dmy
520   PRINT ""
530   GOSUB Pwr_swp_call
540   END IF
```

```
550       !
560   IF Reqd_snsr2_mdl=New_snsr2_model THEN
570   ELSE
580   PRINT "Connect a Gigatronics model";Reqd_snsr2_mdl;"to the channel 2 power sensor cable.",
590   INPUT "Then press ENTER",Dmy
600   GOSUB Pwr_swp_cal2
610   END IF
620       !
630   GOSUB Compare_serno
          ! Calibrates sensors, if necessary.  SEE next example
640       !
650   GOSUB Gain_tst
          ! Configures and performs amplifier gain test.
660   GOSUB Onedb_comp_tst                    ! Configures and performs amplifier 1 dB compression test.
670       !
680   RETURN
690       !
700   Pwr_swp_cal1:
          ! Power Sweep Calibration calibrates the sensor to the meter.
710       !
```

Sensor Serial Number Identification

Tracking sensor serial numbers is important. Measurements cannot be performed unless the sensor has been calibrated to the meter using the built-in power sweep calibrator: this ensures that measurements will never be performed with an uncalibrated sensor. The Giga-tronics 58542 tracks this requirement by reading the sensor's serial number. Thus, by reading in the sensor's serial number at the beginning of measurement subroutines, you can automatically determine whether or not power sweep calibration is required. This is illustrated in the following example.

```
990   Compare_serno:   !
995       !
1000  !#################################################################
1010      !
1020      ! This program identifies sensors by their serial number
1030      ! and jumps to a calibration subroutine if it is a new sensor.
1040      !
1050  !#################################################################
1060      !
1070      ! Sensor Identification routine at beginning of measurement sequence.
1080      ! New sensors will not operate unless they pass calibration first.
1090      !
1100  OUTPUT @Pwr_mtr;"SENS1:CORR:EEPROM:TYPE?"
1110  ENTER @Pwr_mtr;New_snsr1_model,New_snsr1_serno
1120  OUTPUT @Pwr_mtr;"SENS2:CORR:EEPROM:TYPE?"
1130  ENTER @Pwr_mtr;New_snsr2_model,New_snsr2_serno
1140      !
1150  IF Old_snsr1_serno=New_snsr1_serno THEN
1160      !
1170  ELSE
1180  GOSUB Pwr_swp_cal1
          ! New Sensor 1, Must Calibrate To the Meter
1190  END IF
```

```
1200      !
1210  IF Old_snsr2_serno=New_snsr2_serno THEN
1220      !
1230  ELSE
1240  GOSUB Pwr_swp_cal2
          ! New Sensor 2, Must Calibrate To the Meter
1250  END IF
1260      !
1270      ! Concludes Sensor Serial Number Comparison
1280      ! Use a similar routine when a particular sensor model is required.
1290      ! To do both: Nest an IF-THEN for model # ahead of GOSUB
! Pwr_swp_cal#.
1300      !
1310  !###################################################################
1320      !
1330      ! Main loop
1340      !
1350  OUTPUT @Pwr_mtr;"SENS1:AVER:TCON: MOV"
          ! MOV, Average new sample with previous samples
1360  OUTPUT @Pwr_mtr;"SENS2:AVER:TCON: MOV"
          ! MOV, Average new sample with previous samples
1370      !
1380  LOOP
1390  OUTPUT @Pwr_mtr;"MEAS1?"
          ! TRIGGER AND READ CHANNEL 1
1400  ENTER @Pwr_mtr;Meas1
1410  PRINT "CHANNEL 1 IS ";Meas1;"dBm."
1420      !
1430  OUTPUT @Pwr_mtr;"MEAS2?"
          ! TRIGGER AND READ CHANNEL 2
1440  ENTER @Pwr_mtr;Meas2
1450  PRINT "CHANNEL 2 IS ";Meas2;"dBm."
1460  END LOOP
1470      !
1480  !###################################################################
1490      !
1500      ! SUBROUTINES
1510      !
1520      !
1530  Pwr_swp_cal1:
          ! Calibrates Sensor 1  Power Sweep Calibration calibrates the sensor  to the meter.
1540      !
1541  PRINT "Calibrating....."
1550  OUTPUT @Pwr_mtr;"CAL1?"
          ! Starts Calibration and delivers a pass/fail flag
1560  ENTER @Pwr_mtr;Pass_cal
1570  IF Pass_cal=0 THEN
1580  PRINT "Calibration Passed"
1590  Old_snsr1_model=New_snsr1_model
1600  Old_snsr1_serno=New_snsr1_serno
1610  ELSE
1620  PRINT "Calibration FAILED, Sensor 1 Attached To Calibrator?"
1630  WAIT 10                                          ! Wait for Operator to attach sensor
1640  GOTO Pwr_swp_cal1
```

```
1650  END IF
1660  RETURN
1670        !
1680  Pwr_swp_cal2:                                    ! Calibrates Sensor 2
1690        !
1691  PRINT "Calibrating....."
1700  OUTPUT @Pwr_mtr;"CAL2?"
            ! Starts Calibration and delivers a pass/fail flag
1710  ENTER @Pwr_mtr;Pass_cal
1720  IF Pass_cal=0 THEN
1730  PRINT "Calibration Passed"
1740  Old_snsr2_model=New_snsr2_model
1750  Old_snsr2_serno=New_snsr2_serno
1760  ELSE
1770  PRINT "Calibration FAILED, Sensor 2 Attached To Calibrator?"
1780  WAIT 10                                          ! Wait for Operator to attach sensor
1790  GOTO Pwr_swp_cal2
1800  END IF
1810  RETURN
1940  END
```

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Calibrator Controls

OUTPut:Reference:OSCillator

The reference oscillator is the RF calibration source for the sensors.

OUTP:ROSC

OUTPut:ROSCillator[:STATe]*space*<ON or OFF>

```
OUTPUT @Pwr_mtr;"OUTP:ROSC ON"          ! Turn ON Calibrator Oscillator
```

DESCRIPTION

The reference oscillator ("Calibrator" port) connection is located on the front panel of the 58542 VXI Power Meter. The OUTPut:ROSCillator ON command turns on this 0 dBm, 50 MHz output. The reference oscillator's power level should be calibrated annually. Please refer to the Calibration Procedures section on page 6-2 of the Maintenance chapter of this manual for additional details.

OUTPut:ROSCillator[:STATe]?

```
OUTPUT @Pwr_mtr;"OUTP:ROSC?"            ! Query ON or OFF status
```

Response is "1" or "0" (1 = ON)

DESCRIPTION

This query command returns the ON or OFF status of the 58542's built-in reference oscillator.

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Sensor EEPROM Commands

SENSe<sensor 1 or 2>: CORRection:EEPROM:TYPE?
DIAGnostic:SENSe<sensor 1 or 2>:CORRection:EEPROM:CALFRange?
SENSe<sensor 1 or 2>:CORRection:EEPROM:CALFactor?
SENSe<sensor 1 or 2>:CORRection:EEPROM:FREQuency?

SENSe<sensor 1 or 2>:CORRection:EEPROM:TYPE?

```
OUTPUT@Pwr_mtr;"SENS1:CORR:EEPROM:TYPE?"      ! Query sensor 1 eeprom type
```

Typical response is "80301,1818436" which is model number and serial number respectively

DESCRIPTION

This command allows your program to verify correct sensor usage and monitor whether power sweep calibration has been performed or not.

DIAGnostic:SENS<sensor 1 or 2>:EEPROM:CALFRange?

```
OUTPUT @Pwr_Mtr;"DIAG:SENS1:EEPROM:CALFR?"
                                    ! Query sensor 1 eeprom cal factor range table
```

Typical response is "2e9,1e9,17,1" which is the start frequency, step between standard frequencies, frequency, number of standard frequencies, and number of special frequencies.

DESCRIPTION

Provides a count of standard and special cal factors for use in retrieving the data in the next two commands.

SENSe<sensor 1 or 2>:CORRection:EEPROM:FREQuency?

```
OUTPUT@Pwr_mtr;"SENS1:CORR:EEPROM:FREQ?"      ! Query sensor 1 eeprom frequency table
```

Typical response is "5.000e7,2.000e9, ... "

DESCRIPTION

Provides a listing of calibration frequencies in the sensor, sorted by frequency, so that both standard and special frequencies are listed. The number of items matches the sum of the number at standard frequencies, and the number of special frequencies reported by DIAG:SENS1: EEPROM:CALFR?

SENSe<sensor 1 or 2>:CORRection:EEPROM:CALFactor?

```
OUTPUT@Pwr_mtr;"SENS1:CORR:EEPROM:CALF?"      ! Query sensor 1 eeprom cal factor table
```

Typical response is "5.000e7,2.000e9, ... "

DESCRIPTION

Provides a listing of calibration factors in the sensor, sorted in frequency order, to match previous command. The number of items matches the sum of the number at standard frequencies, and the number of special frequencies reported by DIAG:SENS1:EEPROM:CALFR?

Self Test

*TST?

*TST?

```
OUTPUT@Pwr_mtr;"*TST?"                    ! Query self-test result
```

Response is "0" if all OK. Otherwise, it returns one of the code numbers below

DESCRIPTION

If an error occured during Self Test, the amber "TRIG" LED will remain on until cleared by sending the SYST:ERR? command which will return -300 "Device Specific Error; Self Test Failed".

Self Test Error Indications

The following table shows the indications and limitations that will occur when the Self Test command is applied to the 58542 instrument. **The Result, Minimum, and Maximum indications are all given in millivolts.**

Error Number	Result	Minimum	Maximum	Test Description
100	0	0	50	**OUTPUT DAC**
101	1000	950	1050	This test steps the analog output DAC from 0 volts to 10 volts in 1 volt steps, and measures the resultant output voltage with the system ADC. It then compares the results with the limits shown to the left and, if it is outside any limit, it will set the error number corresponding to that voltage level.
102	2000	1900	2100	
103	3000	2850	3150	
104	4000	3800	4200	
105	5000	4750	5250	
106	6000	5700	6300	
107	7000	6650	7350	
108	8000	7600	8400	
109	9000	8550	9450	
110	10000	9500	10500	
200	0	0	50	**OFFSET DAC**
201	1000	950	1050	This test steps the sensor input amplifier offset DAC from 0 volts to 5 volts in 1 volt steps, and measures the resultant output voltage with the system ADC. It then compares the results with the limits stated to the left and, if outside any limit, it will set the error number corresponding to that voltage level.
202	2000	1900	2100	
203	3000	2850	3150	
204	4000	3800	4200	
205	5000	4750	5250	

(continued on next page)

Error Number	Result	Minimum	Maximum	Test Description
				CALIBRATOR DAC
400	0	0	50	This test steps the calibrator control DAC from 0 volts to 10 volts in 1 volt steps, and measures the resultant output voltage with the system ADC. It then compares the results with the limits shown to the left and, if outside any limit, it will set the error number corresponding to that voltage level.
401	1000	950	1050	
402	2000	1900	2100	
403	3000	2850	3150	
404	4000	3800	4200	
405	5000	4750	5250	
406	6000	5700	6300	
407	7000	6650	7350	
408	8000	7600	8400	
409	9000	8550	9450	
410	10000	9500	10500	
				OFFSET AMP 1
600	0	0	50	This test steps the sensor input amplifier offset DAC from 0 volts to 5 volts in 1 volt steps, and measures the resultant output voltage from the first amplifier stage with the system ADC. It then compares the results with the limits shown to the left and, if outside any limit, it will set the error number corresponding to that voltage level.
601	1000	950	1050	
602	2000	1900	2100	
603	3000	2850	3150	
604	4000	3800	4200	
605	5000	4750	5250	
				GAIN AMP 2
800	0	0	50	This test steps the sensor input amplifier offset DAC from 0 volts to 5 volts in 1 volt steps, sets the second stage gain to 1, and measures the second stage output voltage with the system ADC. It then compares the results with the limits shown to the left and, if outside any limit, it will set the error number corresponding to that voltage level.
801	1000	950	1050	
802	2000	1900	2100	
803	3000	2850	3150	
804	4000	3800	4200	
805	5000	4750	5250	

(continued on next page)

Error Number	Result	Minimum	Maximum	Test Description
				THRU FILTER
1000	0	0	50	This test steps the sensor input amplifier offset DAC from 0 volts to 5 volts in 1 volt steps, and measures the filter amplifier output voltage with the system ADC. It then compares the results with the limits shown to the left and, if outside any limit, it will set the error number corresponding to the voltage level.
1001	1000	950	1050	
1002	2000	1900	2100	
1003	3000	2850	3150	
1004	4000	3800	4200	
1005	5000	4750	5250	
				GAIN = 1, AMP 2
Gain = 1, Amp 2: 1200	1000	950	1050	This test sets the sensor input amplifier offset DAC to 1 volt, and measures the output of the second stage amplifier with its gain set to 1. It then compares the results with the limits shown to the left and, if outside any limit, it will set the error number corresponding to that voltage level. Then it sets the gain of the second stage to 8, and measures the output of that stage. Again, any out of tolerance voltage will be indicated by a corresponding error number. This checks the gain of this stage at a gain of 8.
Gain = 8, Amp 2: 1201	8000	7200	8800	
				GAIN = 1, AMP 2
Gain = 1, Amp 2 1400	100	90	110	This test sets the sensor input amplifier offset DAC to 0.1 volt, and measures the output of the second stage amplifier with its gain set to 1. It then compares the results with the limits shown to the left and, if outside any limit, it will set the error number corresponding to that voltage level. Then it sets the gain of the second stage to 64, and measures the output of that stage. Again, any out of tolerance voltage will be indicated by a corresponding error number. This checks the gain of the second stage at a gain of 64.
Gain = 64, Amp 2 1401	6400	5760	7040	

(continued on next page)

Error Number	Result	Minimum	Maximum	Test Description
1600	9000	8000	10000	**TOO HIGH** This test checks the upper limit for the auto-range system by applying a voltage from the offset DAC. The output of the second stage is monitored while also monitoring the "! too-high" comparator output. If the comparator output comes true outside of the voltage limits specified to the left, the corresponding error number is set.
1800	1000	700	1100	**TOO LOW** This test checks the lower limit for the auto-range system by applying a voltage from the offset DAC. The output of the second stage is monitored while also monitoring the "! too-low" comparator output. If the comparator output comes true outside of the voltage limits specified to the left, the corresponding error number is set.
2000	7000	6300	7700	**CAL HEATER** This measures the calibrator thermistor heater voltage. This is half of the actual voltage on the heater transistor collector which will be about 0.5 volts below the level of the 15 volt supply after the heater is stable. Since this takes about a minute after power on, the POST does not check this. However, the command ***TST?** does.
2100	0	0	500	**SW +5 OFF** This test measures the switched 5 volt logic supply applied to the sensor when it is switched off. Whenever a peak power sensor (8034X or 8035XA) is connected, this test will be bypassed.

(continued on next page)

Error Number	Result	Minimum	Maximum	Test Description
2101	5000	4500	5500	**SW +5 ON** This test measures the switched 5 volt logic supply applied to the sensor when it is switched on. Whenever a peak power sensor (8034X or 8035XA) is connected, this test will be bypassed.
3000		0x3c0000	0x3FFFFF	**RAM BANK 1** This does a byte by byte check of the optional extra 128K RAM at addresses 3c0000 to 3fffff hex. An error at any address will result in an error number of 3000. If the optional RAM is not present (which is tested by checking the first byte for write/read cycle ability), then this test is aborted without an error flag.
3001		0x400000	0x43FFFF	**RAM BANK 2** This does a byte by byte check of the standard RAM at addresses 400000 to 43ffff hex. This is done in a non-destructive manner by saving the data that is present and then writing a pattern, reading it back, checking it for validity, and then restoring the original. An error at any address will result in an error number of 3001.
3100		0x300000	0x37FFFF	**ROM** This does a complete checksum of the program ROM at addresses 300000 to 37ffff hex, and compares it with the correct value stored in the ROM. Any error will result in an error number of 3100.

Error Messages

SYSTem:ERRor

SYSTem:ERRor?
OUTPUT @Pwr_mtr;"SYST:ERR?" ! Query system error message

DESCRIPTION

This command reads error messages from the error buffer. Use *CLS and CLEAR @PM_address to clear the SYST:ERR buffer just prior to entering measurement configurations and measurement routines. A listing of compatible standard SCPI error and device specific errors follows.

Standard SCPI Error Messages

Error Number	Description
0	"No Error"
-7	"Invalid Error Number"
-108	"Parameter Not Allowed"
-111	"Header Separator Error"
-113	"Undefined Header; - - - -"
-120	"Numeric Data Error"
-200	"Execution Error"
-211	"Trigger Ignored"
-213	"Init Ignored"
-214	"Trigger Deadlock"
-230	"Data Corrupt or Stale"
-300	**"Device specific errors:**

-Sensor not connected to calibrator"
-Sensor calibration error"
-Sensor zeroing error"
-No sensor"
-Burst mode is off"
-TTL trigger mode not applicable"
-No valid sensor"
-Unable to access application hardware"
-Conflict between upper and lower limits"
-Conflict in channel configuration"
-Counter has to be one in Swift Immediate source"
-No PRE mode for trigger immediate source"
-Normal mode is off"
-Frequency data is above sensor specification"
-Analog out Table is not selected"
-V_prop_f Table is not selected"

-300 **"Device specific errors:** (cont.)

-Analog out Table data input error"
-V_prop_f Table freq data error"
-MAX:STATE is off"
-MIN:STATE is off"
-Channel is not valid"
-Sensor is in CW source mode"
-Sensor calibration error"
-Sensor zeroing error"
-Password is incorrect"
-Sensor eeprom data is over space"
-Sensor eeprom data:freq number does not match"
-Sensor eeprom data:freq is above upper freq limit"
-Sensor eeprom data:freq is below lower freq limit"
-Sensor eeprom data:upper freq should be larger than lower freq"
-Sensor eeprom data:cal factor number does not match"
-Sensor eeprom data:correction factor number does not match"
-Sensor eeprom data:write error"
-Normal mode is on"
-Sensor is not calibrated"

Device Specific Error Message Command / Problem Resolution Table

COMMAND	ERROR MESSAGE	EXAMPLE OF TYPICAL PROBLEM
ABORt		
CALCulate1:DATA?	Burst mode is off	Not burst mode, Command requires BURSt mode
CALCulate1:DIFFerence 1,1 CALCulate1:RATio 1,1	Conflict in channel configuration	Same sensor
CALCulate1:LIMit:LOWer :UPPer	Conflict between upper and lower limits	Upper is smaller than lower or lower is greater than upper
CALCulate1:MAXimum?	MAX:STATe is off Channel is not valid	Mode is off No sensor or sensor is not calibrated
CALCulate1:MAXimum:STATe	Channel is not valid	No sensor or sensor is not calibrated
CALCulate1:MINimum?	MIN:STATe is off Channel is not valid Channel is not valid	Mode is off No sensor or sensor is not calibrated No sensor
CALCulate1:MINimum:STATe	Channel is not valid	No sensor or sensor is not calibrated
CALCulate1:MODE	No valid sensor Channel is not valid	No sensor No sensor or sensor is not calibrated
CALCulate1:POWer	No valid sensor	No sensor
CALCulate1:REFerence:COLLect	Normal mode is off Channel is not valid	Burst mode setup No sensor or sensor is not calibrated
CALibrate1 CALibrate1?	No sensor Sensor not connected to calibrator Sensor calibration error	No sensor Calibration error
CALibrate1:ZERO CALibrate1:ZERO?	No sensor Sensor zeroing error	Zeroing error
DIAGnostic:CTABle? 1	Sensor is not calibrated No Sensor	No sensor table is available No sensor
DIAGnostic:SENSe1:EEPROM:CORRection	No valid sensor Sensor eeprom data:correction factor number does not match	No sensor

COMMAND	ERROR MESSAGE	EXAMPLE OF TYPICAL PROBLEM
DIAGnostic:SENSe1:EEPROM:CORRection? DIAGnostic:SENSe1:EEPROM:READ	No valid sensor	No sensor
DIAGnostic:SENSe1:EEPROM:CALFSPecial DIAGnostic:SENSe1:EEPROM:CALFSTandard	No valid sensor Sensor eeprom data is over space Sensor eeprom data:cal factor number does not match	No sensor Too much data
DIAGnostic:SENSe1:EEPROM:CALFSPecial?	No valid sensor Sensor eeprom data is over space	No sensor Too much data
DIAGnostic:SENSe1:EEPROM:CALFSTandard? DIAGnostic:SENSe1:EEPROM:FREQSPecial? DIAGnostic:SENSe1:EEPROM:FREQSTandard?	No valid sensor Sensor eeprom data is over space	No sensor Too much data
DIAGnostic:SENSe1:EEPROM:CALFRange DIAGnostic:SENSe1:EEPROM:CALFRange? DIAGnostic:SENSe1:EEPROM:TYPE DIAGnostic:SENSe1:EEPROM:TYPE?	No valid sensor	No sensor
DIAGnostic:SENSe1:EEPROM:FREQSPecial	No valid sensor Sensor eeprom data is over space Sensor eeprom data:freq is above upper freq limit Sensor eeprom data:freq is below lower freq limit Sensor eeprom data:freq number does not match	No sensor Too much data
DIAGnostic:SENSe1:EEPROM:TYPE	No valid sensor Sensor eeprom data:upper freq should be larger than lower freq	No sensor
DIAGnosticSENSe1:EEPROM:WRITe	No valid sensor Sensor eeprom data:write error Password is incorrect	No sensor Sensor eeprom error Password is activated
DIAGnostic:ZTABle? 1	No sensor	No sensor
FETCh1?	Data corrupt or stale TTL trigger mode not applicable	No valid sensor Normal mode
INITiate:IMMediate	Init ignored	Continuous is on
MEASure1?	Data corrupt or stale Normal mode is off	No valid sensor Burst or swift mode
MEMory:TABLe:FREQuency	No valid sensor V_prop_f Table is not selected V_prop_f Table freq data error	No sensor Select others Start freq is greater than sensor maximum

COMMAND	ERROR MESSAGE	EXAMPLE OF TYPICAL PROBLEM
MEMory:TABLe:FREQuency?	V_prop_f Table is not selected	Select others
MEMory:TABLe:POWer	Analog out Table is not selected Analog out Table data input error	Other table Lower power is greater than upper power
MEMory:TABLe:POWer?	Analog out Table is not selected	Other table
MEMory:TABLe:SLOPe	No valid sensor V_prop_f Table is not selected	No sensor Select others
MEMory:TABLe:SLOPe?	V_prop_f Table is not selected	Select others
MEMory:TABLe:UNIT MEMory:TABLe:UNIT?	Analog out Table is not selected	Other table
MEMory:TABLe:VOLTage	Analog out Table is not selected Analog out Table data input error	Other table Lower voltage is greater than upper voltage
MEMory:TABLe:VOLTage?	Analog out Table is not selected	Other table
READ1?	Data corrupt or stale Normal mode is off Trigger deadlock	No valid sensor Burst or swift mode is on TRIG:SOUR is not in IMM mode
SENSe1:EEPROM:CALFactor? SENSe1:EEPROM:FREQuency?	No valid sensor Sensor eeprom data is over space	No sensor Too many data
SENSe1:CORRection:VPROpf:STATe SENSe1:CORRection:VPROpf:STATe?	No valid sensor	No sensor
SENSe1:FREQuency	Frequency data is above sensor specification	
SENSe1:OFFSet:COLLect	Normal mode is off Channel is not valid	In burst or swift mode No sensor
SENSe1:TRIGger:DELay SENSe1:TRIGger:LEVel	No valid sensor Sensor is in CW source mode	No pulse sensor
SENSe1:TRIGger:DELay? SENSe1:TRIGger:DELay:SOURce SENSe1:TRIGger:DELay:SOURce? SENSe1:TRIGger:DELay:STATe ON SENSe1:TRIGger:DELay:STATe? SENSe1:TRIGger:DELay:LEVel?	No valid sensor	No pulse sensor

COMMAND	ERROR MESSAGE	EXAMPLE OF TYPICAL PROBLEM
TRIGger:COUNter	Normal mode is on Counter has to be one in Swift immediate source No valid sensor Channel is not valid	Not in burst or swift mode Swift mode, imm source No sensor Ratio mode setup
TRIGger:COUNter?	Normal mode is on No valid sensor Channel is not valid	Not in burst or swift mode No sensor Ratio mode setup
TRIGger:IMMediate	Init ignored	Source is in immediate mode
TRIGger:MODE PRE	No PRE mode for trigger immediate source	
TRIGger:SOURce:IMMediate	Counter has to be one in Swift immediate source No valid sensor Channel is not valid	Swift mode is on No sensor Ratio mode setup)

Appendix A

IEEE Commands Accepted by the 58542 VXI Power Meter

Mnemonic	Name	IEEE 488.2 Section
***CLS**	Clear Status Command	10.3
***ESE**	Standard Event Status Enable Command	10.10
***ESE?**	Standard Event Status Enable Query	10.11
***ESR?**	Standard Event Status Register Query	10.12
***IDN?**	Identification Query	10.14
***OPC**	Operation Complete Command	10.18
***OPC?**	Operation Complete Query	10.19
***RST**	Reset Command	10.32
***SRE**	Service Request Enable Command	10.34
***SRE?**	Service Request Enable Query	10.35
***STB?**	Read Status Byte Query	10.36
***TST?**	Self-Test Query	10.38
***WAI**	Wait-to-Continue Command	10.39

CHAPTER 4

PERFORMANCE VERIFICATION TESTS

GENERAL

Information in this section is useful for periodic evaluation of the Model 58542 VXI Power Meter and its power sensors. These tests can also be used for incoming inspection testing when the instrument is first received, if required.

If the 58542 Power Meter has not previously been used, Chapter 2 of this Manual should be reviewed to ensure that the instructions covering GPIB address selection have been complied with before the instrument is turned on. Prior to starting the following procedures, the instrument should be allowed to warm up for at least 24 hours to assure maximum stability during testing.

The Specification Test for the Calibrator Output Power Reference Level given in this section is valid for an ambient temperature range between +15°C and +35°C (+59°F to +95°F).

The instrument plus power sensor linearity test is valid when the sensor has been calibrated using the front panel calibrator at a temperature between 0°C and +50°C (+32°F to +122°F), and if operating within ±5°C (±9°F) of that calibration temperature.

It is recommended that the verification be done in the order described since some of the steps use the configuration from a previous step.

EQUIPMENT REQUIRED

Description	Representative Model	Key Characteristics
CW Thermistor Power Meter	HP 432A	V_{RF} and V_{COMP} available externally
Thermistor Mount	HP 478A-H75	≤1.07 VSWR @ 50 MHz (30 dB return loss) Accuracy ±0.5% @ 50 MHz
Digital Voltmeter (DVM)	Fluke 8842A	±0.05% accuracy & 1 μV resolution
Directional Coupler, 10 dB	Mini Circuits ZFDC-10-1 10 dB	≤1.15 SWR @ 50 MHz
Step Attenuator, 0 to 90 dB in 10 dB increments	Weinshel Model AC 118A-90-33	≤1.15 SWR @ 50 MHz ±0.1 dB attenuation
RF Source (Signal Generator) (High Power)	Wavetek Model 2405 Option XP	+22 dBm @ 50 MHz
Low Pass Filter	Integrated Microwave Model 904 881	>30 dB attenuation @ 100 MHz
GPIB Controller for IBM PC	National PC2/2A	With driver software

Performance Verification Test Data Recording sheets are located starting on page 4-11. These sheets can be copied, and the copies used for recording test results each time Performance Verification testing is performed on the specific instrument described by this manual.

GPIB Port Check

The following steps are used to confirm that the GPIB port is functional.

1. Set the 58542 to the desired address.
   (See Chapter 2 for address setting instructions if necessary.)

2. Connect the GPIB controller to the GPIB Port of the "SLOT 0" plug-in next to the 58542. (See Figure 4-1 on the next page.)

3. Send the command:

   ***IDN?**

   This is the standardized COMMON identify query command as defined by IEEE 488.2 1988. When talk addressed after receiving the command, the 58542 will output a string that identifies itself as the 58542 VXI Power Meter.

4. Display the response on the controller. It should be similar to:

   "Giga-tronics 58542, 0, 1.10" (the last number will be the current software revision number)

*NOTE: If the instrument will not respond to the *IDN? command, see the Note at the top of page 5-17.*

TEST PROCEDURES

Calibrator Output Power Reference Level

The Calibrator Output power reference is factory adjusted to 1 mW ±0.7%. To achieve this accuracy, Giga-tronics uses a precision measurement system with accuracy to ±0.5% (traceable to the NIST), and allows for a transfer error of ±0.2% for a total of ±0.7%. If an equivalent measurement system is used for verification, the power reference oscillator output can be verified to 1mW ±1.9% (±1.2% accuracy + ±0.5% verification system error + ±0.2% transfer error = ±1.9% maximum error). To ensure maximum accuracy in verifying the Calibrator Output power reference, the following procedure provides step-by-step instructions for using specified test instruments of known capability. If equivalent test instruments are substituted, refer to the Key Characteristics section in the table of Equipment Required on the preceding page.

Figure 4-1, below, can be used as a guide for assembling the test setup.

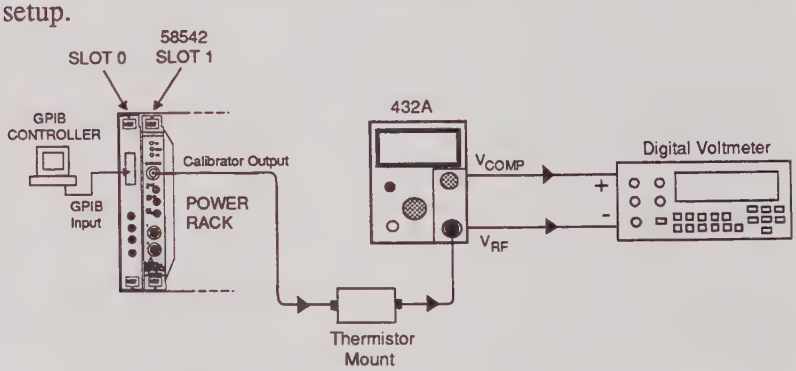


Figure 4-1. Calibrator Output Power Reference Level Test Setup

PROCEDURE

In the following steps, precision power measurements will be made using the 432A Power Meter. For detailed information on using the 432A, please refer to the operating section of the 432A manual.

1. Connect the 432A to the Calibrator Output on the 58542 as shown in Figure 4-1.

2. Turn on all equipment and then wait 30 minutes for the thermistor mount to stabilize before proceeding to the next step.

3. Set the 432A RANGE switch to COARSE ZERO, and adjust the front panel COARSE ZERO control to obtain a zero (±2% F.S.) meter indication.

NOTE: Ensure that the DVM input leads are isolated from chassis ground when performing the next step.

4. Set the DVM to a range that results in a resolution of 1 μV and connect the positive and negative input, respectively, to the V_{COMP} and V_{RF} connectors on the rear panel of the 432A.

5. Fine zero the 432A on the most sensitive range, then set the 432A range switch to 1 mW.

6. Record the DVM indication as V_0.

7. Turn ON the 58542 Calibrator RF power as follows:

   Send **"OUTP:ROSC ON"**
   Record the reading shown on the DVM as V_1.

   NOTE: The V_1 reading must be taken within 15 seconds after entering the command. *Otherwise, turn REF POWER OFF as shown in Step 9 and repeat Steps 6 and 7.*

8. Disconnect the DVM negative lead from the V_{RF} connector on the 432A, and reconnect it to the 432A chassis ground. Record the new indication observed on the DVM as V_{COMP}.

9. Send **"OUTP:ROSC OFF"**

10. Calculate the Calibrator Output level (P_{CAL}) using the following formula:

$$P_{CAL} = \frac{2V_{COMP}(V_1 - V_0) + V_0^2 - V_1^2}{4R\,(\text{CALIBRATION FACTOR})}$$

where:

P_{RF} = Calibrator Output power reference level
V_{COMP} = previously recorded value in Step 8
V_1 = previously recorded value in Step 7
V_0 = previously recorded value in Step 6
R = 200Ω (assuming HP478A-H75 mount)

CALIBRATION FACTOR = value for the thermistor mount at 50 MHz (traceable to NIST)

11. Verify that the P_{CAL} is within the following limits:

1 mW ±0.019 mW
(0.981 to 1.019 mW)

(For record purposes, the measured value of P_{CAL} can be entered on the Test Data Recording Sheet located on page 4-11.)

Instrument Plus Power Sensor Linearity

TEST DESCRIPTION

Connect the test setup as shown in Figure 4-2 on the next page. The linearity will be tested over the range +20 dBm to -60 dBm. At low power levels, the linearity measurement will include the uncertainty due to the zero set specification. The procedure should be repeated for each sensor used with the 58542.

When measuring the linearity of a Low VSWR (Model 8031X Series) or a High Power (Model 8032X Series) sensor, the power output of the source must be increased by 6 or 10 dB respectively and the directional coupler must be increased from 10 dB to either 16 or 20 dB respectively (see Figure 4-2). The power coefficient of the step attenuator will also have to be considered. The specification of power coefficient for the Weinchel attenuator cited in the Equipment List is: <0.005 dB/dB/W. The latter will effect the linearity of each 10 dB segment, and make it necessary to expand the overall linearity specification by this quantity.

In assembling the test setup shown in Figure 4-2, keep in mind that if testing is to be conducted with Low VSWR or High Power sensors, the optional RF Amplifier must have frequency and bandwidth to match the sensor's characteristics (see page 1-7, Sensor Selection Guide, if unsure of characteristics), and the Directional Coupler must be increased as stated above for the particular series of sensors. All Standard (Model 8030X) and True RMS (Model 8033X) sensors are tested without the optional RF Amplifier, and with a 10 dB Directional Coupler.

Refer to the Linearity Data recording section of the Performance Verification Data recording sheets located on pages 4-11 and 4-12. The tolerance is already entered for the various steps, and includes an allowance for specified zero set errors at low power levels.

To ensure accurate and repeatable measurements, the 432A power meter should be zeroed just before taking each reading that will be used to calculate "P1" in the Power Meter column of the Performance Verification Test Data Sheets on pages 4-11 and 4-12.

SETUP PARAMETERS

The following setup parameters should be accomplished prior to performing the Power Linearity test:

A. The 58542 and sensor should be calibrated by following the instructions given on page 3-19 of the Operation chapter of this manual.

B. The Averaging is set to AUTO by entering:

"SENS1:AVER:COUN:AUTO ON" (enter SENS2 for channel 2)

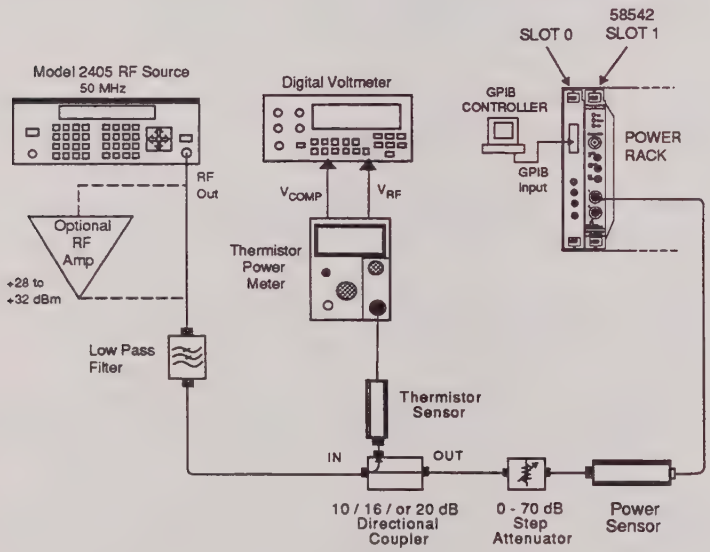


Figure 4-2. Power Linearity Test Setup

NOTE 1: Extreme care is required in the following procedure since the accuracy requirements are critical to ensure the most accurate test results.

NOTE 2: Power readings are determined using the thermistor power meter in the same general way as given in the Power Reference Level test. That is, "P1" and "P2" in the Power Meter reading column of the Performance Verification Test Data Sheet tables are calculated each time for the respective values of V_{COMP}, V_0, and V_1 as read on the DVM.

TEST PROCEDURE

1. Set the step attenuater to 70 dB. Turn the source power output off, and then zero the 58542.

   (The 58542 is zeroed by sending **"CAL1:ZERO"**)

2. Set the step attenuator to 0 dB after the 58542 has zeroed.

3. Set the power output of the RF source so that the thermistor power meter indicates 1.00 mW ±0.025 mW.

4. Record the calculated power meter reading and the 58542 reading in the correct columns of the Linearity Data recording sheet on page 4-11. [The 58542 data is obtained by sending **"MEAS1**(or 2)**?"** and then receive the data.]

5. Set the power output of the RF source so that the thermistor power meter indicates 3.98 mW ±0.10 mW.

6. Record the new calculated power meter reading and the new 58542 reading as in Step 4, above.

7. Set the power output of the RF Source so that the thermistor power meter indicates 3.98 mW ± 0.10 mW.

8. Record the calculated power meter reading and the 58542 reading as in Step 4, above.

9. Set the power output of the RF Source so that the thermistor power meter indicates 5.01 mW ± 0.13 mW,

10. Record the new calculated power meter reading and the new 58542 reading as in Step 4, above.

11. Repeat using the power meter indications in the Data Recording sheet on page 4-12. Note that the Step Attenuator is used to generate the remaining 70 dB range of 10 dB steps for a total range of 80 dB. Repeat Step 1, above, between each 10 dB step shown on the Linearity Data Recording sheet.

12. Make the calculations indicated on the Linearity Data sheet, and enter the values in the appropriate blank spaces.

This completes the Performance Verification Tests for the 58542 VXI Power Meter and its sensors. If the instrument has performed as described in this chapter, it is correctly calibrated and within specifications.

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GIGA-TRONICS 58542 VXI POWER METER PERFORMANCE VERIFICATION TEST DATA SHEET

Date: _____ Model 58542 S/N: _____

Operator: _____ Power Sensor S/N: _____

Test Number: _____ (if required)

Calibrator Output Power Reference

Minimum	Actual Reading	Maximum
0.981 mW		1.019 mW

Linearity Data - (+16 dBm to +20 dBm)

Step Attenuator Value	Power Set Point	Power Meter Reading (P)	58542 (DUT) Reading (R)	Reference Power Ratio	58542 (DUT) Reading Ratio	[1] Linearity Error (%)	
						Linearity Specification	[2] Accumulated Linearity Error
0 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	3.98 mW ±0.10 mW	P2 =	R2 =			±1%	*Same as Lin. error above*
0 dB	3.98 mW ±0.10 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	5.01 mW ±0.13 mW	P2 =	R2 =			+1% -1.6%	
0 dB	5.01 mW ±0.13 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	6.31 mW ±0.16 mW	P2 =	R2 =			+1% -2.7%	
0 dB	6.31 mW ±0.16 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	7.94 mW ±0.2 mW	P2 =	R2 =			+1% -3.8%	
0 dB	7.94 mW ±0.2 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10 mW ±0.25 mW	P2 =	R2 =			+1% -4.9%	

(continued on next page)

[1] Linearity Error (%) = [(R1/R2) / (P1/P2) - 1] * 100

[2] Accumulated error is the sum of the current dB segment linearity error plus the previous accumulated error.

Linearity Data - (+16 dBm to -60 dBm)

Step Attenuator Value	Power Set Point	Power Meter Reading (P)	58542 (DUT) Reading (R)	Reference Power Ratio	58542 (DUT) Reading Ratio	[1] Linearity Error (%)	
						Linearity Specification	[2] Accumulated Linearity Error
0 dB						[3] See Below	
						±1%	*Same as Lin. error above*
10 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1%	
20 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1%	
30 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1%	
40 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1%	
50 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1%	
60 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1.5%	
70 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±6%	

[1] Linearity Error (%) = [(R1/R2) / (P1/P2) - 1] * 100
[2] Accumulated error is the sum of the current dB segment linearity error plus the previous accumulated error.
[3] Use the first CW Linearity error value entered in the +16 dBm to +20 dBm table on page 4-11.

CHAPTER 5

ELECTRICAL DESCRIPTION

GENERAL

This chapter of the Model 58542 Operating and Maintenance Manual contains a functional description of the electrical circuits contained on the PC board assemblies of the 58542 Universal Power Meter. Table 5-A, below, lists the circuit assemblies by their reference designations, and includes the Schematic Diagram (SD) and assembly part number for each board.

Table 5-A. 58542 Power Meter Circuit Assemblies

Reference Designation	Nomenclature	Assembly No.	SD No.[1]
A1	Analog PC Bd Ass'y	21359	21360
A2	Digital PC Bd Ass'y	21356	21357
A3	VXI Processor PC Board Ass'y	21418	(See NOTE on page 5-17)

[1] "SD" stands for Schematic Diagram

System Description

(See SD 21406 on page 7-3 for specific interconnect information.)

The 58542 Power Meters electrical circuitry resides mainly on three PC boards; the Analog PC Board (A1), the Digital PC Board (A2), and the VXI Processor PC Board (A3). The Processor contains the microprocessor, some ROM and RAM, and the VXI interface chip. The remainder of the required ROM and RAM is contained on the Digital board.

Two cables interface to the meter through the VXI Bus Interface connections located on the rear panel. The Bus Interface goes to the Processor board through connectors P1 and P2. Three front panel BNCs connect to the Analog board.

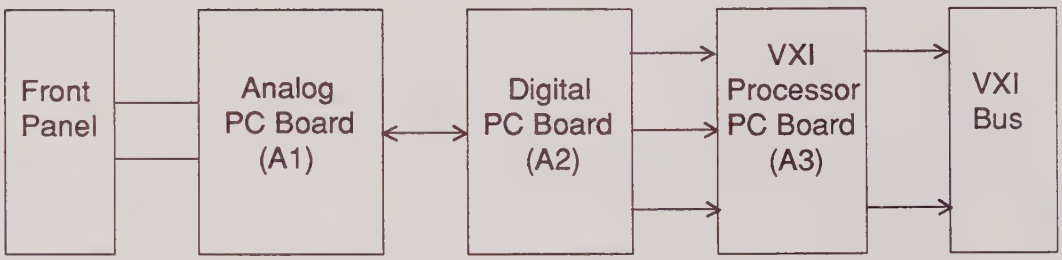


Figure 5-1. Model 58542 VXI Power Meter Block Diagram

THIS PAGE IS PART OF A FOLD-OUT SHEET. PLEASE FOLD THIS SHEET OUT TO THE LEFT AND START WITH THE TEXT ON PAGE 5-5.

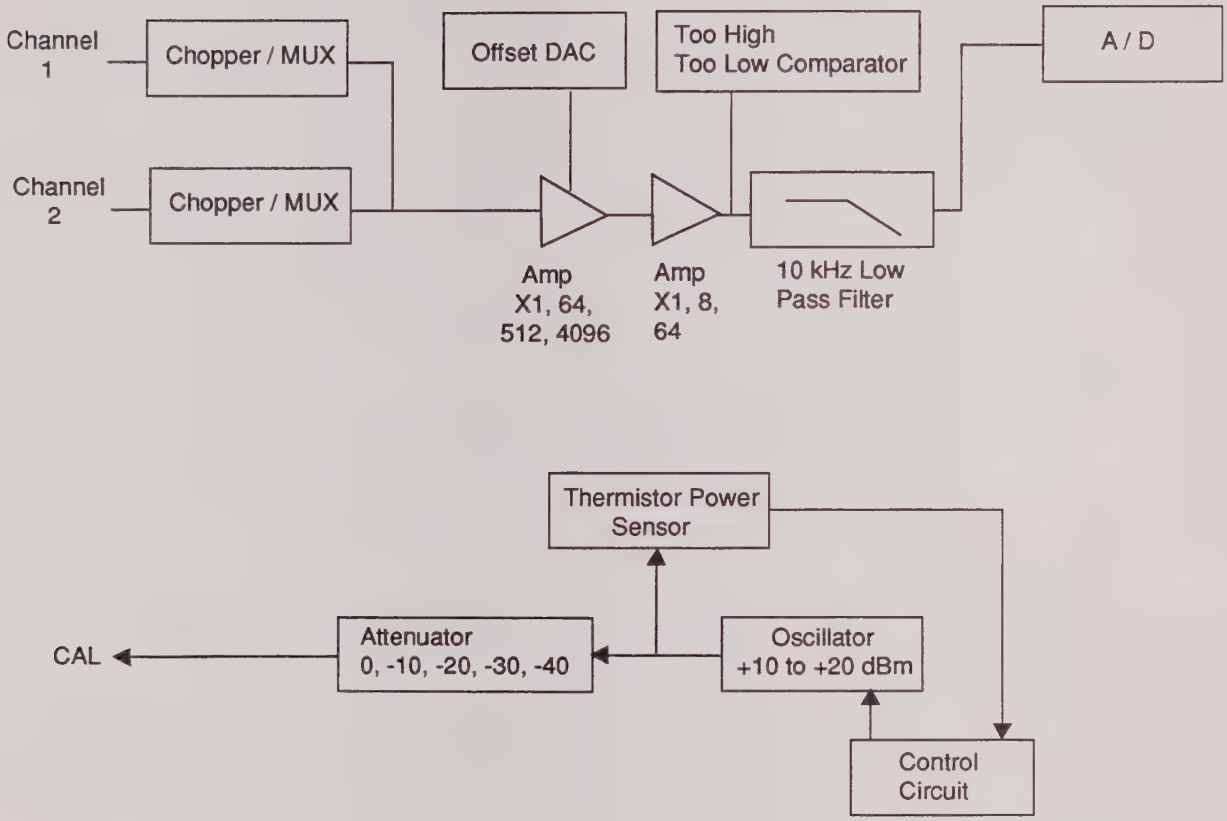


Figure 5-2. Analog PC Board Assembly (A1) Block Diagram

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Analog PC Board (A1)

(Refer to Figure 5-2 on page 5-3 and SD 21360 starting on page 7-5)

Sheet 1 of SD 21360 on page 7-5 shows the Channel 2 sensor amplifier circuitry, and Sheet 2 on page 7-7 covers the Channel 1 sensor amplifier circuits.

The sensors are connected from the front panel through W3 & W2 which are connected to the Analog Board through W2P1 & W2P2 for sensor 1 and W3P1 & W3P2 for sensor 2. The detected DC voltage from the sensor is a differential voltage applied to pins 3 and 4 of J7 or J9. This differential voltage goes to U28 or U29 which is a FET chopping circuit. The outputs are pins 8 and 9 of the chopper. An incoming signal can either be fed straight through or inverted. The signal is fed straight through when A1 and A0 are both low. It is fed through in the inverted mode when A1 is low and A0 is high. When A0 is low and A1 is high the signal is shorted together and grounded, and when A0 and A1 are both high, the input is open (floating). This provides chopper stabilized amplification when low power signals are being received by switching the FET switch from the inverting to non-inverting mode and back again at a rate of 300 times per second.

U31 is the 1st stage amplifier, and has programmable gain. The programmable gain is provided by U30 and the resistor ladder composed of R6 through 12 which will program gains of 1, 64, 512, and 4096. U32A is the 2nd stage amplifier that provides programmed gains of 1, 8, and 64 using FET switch U33 and resistor ladder R16, R17, and R18. C167 (though shown on the schematic) is not loaded on the board.

U32B/C/D and associated components provide a 6 pole bessel filter in the low pass configuration - 10 kHz with a 120 µs settling time. In normal operation, the signal will always go through this filter. Other paths such as unfiltered, TP8, and firstamp signals are provided for testing only and not used in normal operation.

The 1st amplifier, U31, has an offset voltage injected into it via pin 7. This offset voltage comes from the 12 bit DAC, U15. Offset voltages range from +5V to -5V which can effectively remove about a ±1.2 mV offset at the detector. U34A&B are comparators which monitor the input signal for a too high or too low condition. The too low comparator, U34B, will fire if the voltage is below 1V, and the too high comparator, U32A will fire if the voltage is

above 9V. This provides an A/D conversion range of 1 to 9V. The too high and too low signals are used by the software to determine whether or not a range change should be made. There are 7 ranges. Four ranges are processed by U31 (1st Amp), and three ranges by U32A. Appropriate gains are set to keep voltages at the A/D conversion point between 1V and 9V. R45 and R46, divide the 12V regulated voltage to 1V such that the too low comparator will fire below 1V to assert the too low signal. R36 and R37, divide the 12V signal to 3V, and R40 and R41 divide the incoming signal by 3 so that the too high comparator will always fire at 9V.

Refer to Sheet 2 (Channel 1) of SD 21360 on page 7-7.

Each detector has a thermistor included in its housing so that the power meter can read the temperature of the sensor. The voltage from that thermistor is applied through J7-6 (for channel 1) and amplified by a gain of 2 by U35C (shown on Sheet 2). Channel 2 sensor's thermistor voltage comes in through J9-6 and is amplified by 2 at U35A. The thermistor voltages are also routed to U35D and U36A&B. This circuit is used to detect whether a sensor has been attached or disconnected. The connection or disconnection of a sensor causes a transient voltage which is passed through C10 (for channel 2) or C11 (for channel 1). This is detected by a window comparator consisting of U35D and U36A&B. Whenever the voltage is outside the normal DC bias range, the detector change will cause either a rise or a fall in the voltage that will be detected by the comparator. The comparator will output an interrupt to the processor, IRQ, which will be the output of U36A&B.

U16A and U9A provide a latch for the interrupt so that the processor will have time to respond. Pin 2 of U9A is used to enable or disable interrupts. U36C buffers the interrupt signal. The interrupt 1 signal goes to the CPU Board.

The sensors also have EEPROMs that connect to the system through a serial interface. Channel 1 uses J8-6 for the clock and J8-5 for the data. This is a bi-directional device wherein data needs to be written to the sensor and also read from the sensor. U24E buffers incoming data, and U24F buffers outgoing data. Q3 provides the necessary open collector interface. U26 supplies the clock during a read or write action. The clock signal is buffered by U24D. Channel 2 has a duplicate circuit consisting of U24A/B/C and Q2. DC supplies of +5V and ±15V are also routed to the sensors. The 15V supplies are routed through solid state fuses to provide protection in case of any shorts. These are resettable solid

state fuses which do not need to be replaced. The +5V can be switched on and off. This is controlled by U26, and buffered by Q8 and Q1.

Refer to Sheet 3 of SD 21360 on page 7-9. To recap the preliminary actions of the incoming signals; they first go through the chopper, the 1st stage amplifier, the 2nd stage amplifier, and then the filter. The signals are then sent to U23, a 16 to 1 multiplexer. U23 can select 1 signal to route to U25, the A to D converter. Most of the other signals are used for testing purposes only. During normal operation, the signal path will be through the bessel filter.

Thermistor voltages come in on pins 24 and 25 for channels 1 and 2. The only other signal that is used for normal operation is the V prop. F input that comes in through the J3 BNC on the front panel. CR15 provides input protection, and U21A is a x1 amplifier/ buffer. The V prop F signal can be read at pin 26 of the multiplexer. U25 is a 14 bit A/D which operates at an 11 µs conversion time. The input is via pin 6 on TP13, and this device can measure between 0 and 10V. U25's operating power supplies are limited to ±12V (pins 11 and 5). Those voltages are derived from ICs U39 and U43 which regulate the ±15V to ±12V.

R105, R104, and C31 configure U33 to measure from 0 to 10V. Pin 4 of U33 provides the start convert signal, and the processor will assert this signal to start an A/D conversion. After the A to D conversion has completed, pin 3 can be asserted to output the data to the bus. These two functions are supplied by chip select ACS7 and ACS1. ACS1 is the output enable, and ACS7 is the start convert. EOC is end of convert which occurs at pin 2 of U33. That is routed to data byte 15 so that the process can interrogate to see if the data conversion is complete. D15 will be asserted if the A/D has completed its conversion.

U15 is the offset D/A which provides the 1st stage amplifier with ±5V offset voltages. This is a 12 bit D/A converter. U17 is similar, but is configured for 0 to 10V. The output of U17 is buffered by U21B, current limited by R108, and is available at the J4 BNC connection for analog output.

U23 has a number of signals available for testing purposes. Offset voltage is available on pin 5. Output DAC voltage is available on pin 4, and switched 5V signals on pin 7.

Sheet 5 of SD 21360 on page 7-13 covers the interconnections for the Calibrator circuitry and will be discussed starting on the next page, but U27 also serves the purpose of providing three 8-bit ports that are available for control of the multiplexers used in the Analog section, and an input port for the too high and too low comparators.

Calibrator Module

(Refer to SD 21360, Sheet 5, on page 7-13)

The Calibrator Module is located on the Analog PC Board. It is basically the heart of the 58542 Power Meter in that it is a patented system that allows the power sensors to be calibrated against an internal thermistor power standard (see Figure 5-3 below). In contrast to the conventional fixed-level calibrators, the 58542 calibrator produces a range of power levels over a 50 dB dynamic range to an accuracy of a few thousandths of a dB.

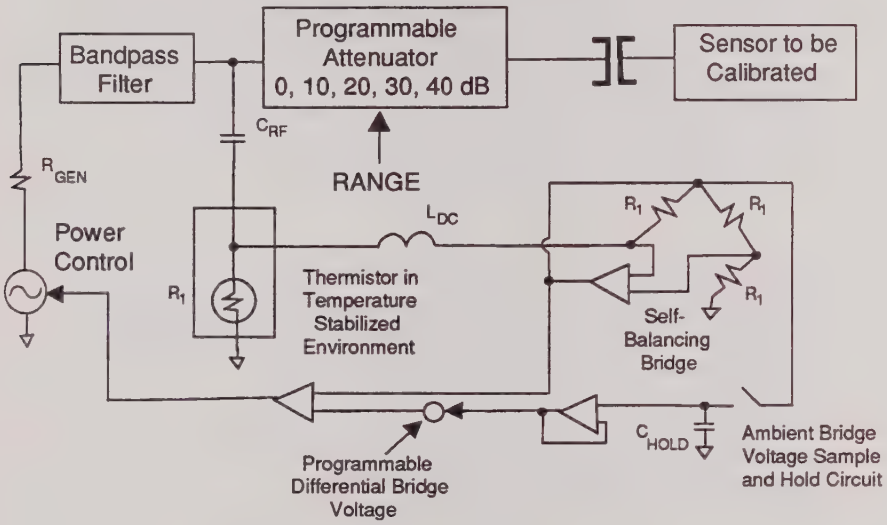


Figure 5-3. Calibrator Internal Power Standard Configuration

The thermistor is mounted in a self-balancing bridge configuration using DC substitution in the bridge. In this arrangement, the thermistor is maintained at a fixed operating point and the DC power in the thermistor, P_{DC}, is related to the RF power, P_{RF}, by the simple relationship:

$$P_{DC} + P_{RF} = P_{AMBIENT} = \text{constant}$$

The constant, $P_{AMBIENT}$, is found by turning the RF power off and measuring the ambient voltage, $V_{AMBIENT}$, to which the self-balancing bridge settles. The advantage of this approach is that the linearity of the thermistor-leveled oscillator is limited only by the accuracy with which DC voltages can be measured and the stability of the RF calibrator. To ensure exceptional stability, the thermistor assembly is enclosed in a temperature-stabilized environment and a

low drift sampling circuit is used to hold the ambient bridge voltage. The RF power can then be programmed by controlling a difference voltage, δV, at the summing node. The power is related to the voltage by:

$$P_{RF} = \frac{V_{AMBIENT}\,\delta V - \delta V^2}{R_1} - \frac{\delta V^2}{2R_1}$$

This permits the RF power to be precisely controlled over a dynamic range of about 12 to 15 dB. The dynamic range is extended using a switched attenuator, the properties of which are determined using the thermistor-leveled oscillator itself. The effective attenuation (including all mismatch effects) of each attenuator relative to the next is measured by finding a pair of powers, one for each attenuator, that produces identical signals from the sensor under test. Because the sensor under test is used at a fixed operating point, no knowledge of its detection law is required.

General

The operation of the various circuitry functions of the Calibrator Module can be understood more easily if the circuits are discussed individually. The 11 functional sections of this module include the following:

1. The 50 MHz oscillator, Q4, and its current control circuit consisting of U4D, Q5, and U2C.

2. The RF output circuit consisting of the low pass filter, the stepped attenuator, and the connector and cable to the front panel of the 58542 meter.

3. The oven that maintains the control thermistor at a constant 60°C which is located on the small board attached to the bottom of the heater transistor, Q1. The board has two thermistors, RT1 and RT2, and Q7, the control transistor.

4. The thermistor bridge used to measure the RF power by DC substitution, consisting of RT1, U1, and Q6.

5. The track and hold circuit that remembers the ambient bridge voltage, using U2B, U8D, and U3A.

6. The 14 bit DAC and reference supply used to measure the ambient bridge voltage and control the RF output level, made up of U11, U7, U8C&D, U4, U14A, U2A&B, U3A, U5, U10, U16B&C, U13B&C, and U9B.

7. The correction circuit used to measure the temperature of the PIN diode attenuator so that a correction for the temperature dependent loss of the diodes can be corrected, consisting of RT2 and U14C.

8. Calibrator NVRAM control circuit, U26 and U18.

50 MHz Oscillator

The first section of the Calibrator Module Assembly circuitry consists of a colpits oscillator circuit with a controllable power output. The output power is measured by the thermistor bridge and set by varying the DC current through Q4. This current is supplied by a voltage to current converter circuit consisting of U14D, Q5, and U4. The power generated by Q4 is nearly linearly related to the current through it. Thus, the voltage from U4 that is converted to current by U14D and Q5 is linearly related to the RF power generated. When the calibrator is set for 0 dBm, the voltage at U4-6 is near 0 volts.

RF Output

The 50 MHz oscillator output is capacity coupled to the low pass filter, L13, L14, L15, and associated capacitors. The resultant harmonic-free RF is applied to the switched PIN attenuator, CR8 - 14, and associated resistors and control amplifiers U19 and U14B. The first section is 10 dB, the output section is 20 dB, and a resistor between sections adds another 10 dB. Thus, the output power can be programmed from +20 to -30 dBm.

Oven

The measuring thermistor is maintained at a constant 60°C by being mounted on the heater transistor, Q1, which is driven from the sensing thermistor RT2 by way of the current amplifier, Q7. RT2 is mounted very close to RT1 so that both are maintained at the same temperature. When RT2 gets to a temperature of 60°C, the voltage across it is just enough to maintain drive to the heater. This condition will be maintained regardless of the ambient temperature.

Thermistor Bridge

RT1 is connected in a self-balancing bridge circuit which will deliver just enough power to the thermistor to keep it at 500 ohms. Thus, if part of the power delivered to it is from the RF generated by the oscillator and the rest is from the DC current of the bridge, then by reducing the amount of DC power, the circuit will increase the drive to the oscillator as needed to keep the total power in RT1

constant. It is only necessary to measure the amount of DC power reduction to know the amount of RF power present. In this way, a precisely known RF output level can be established.

Track & Hold and DAC

In order to know how much power is being added by the oscillator, it is necessary to measure the power delivered to the thermistor with no RF present. This is done by turning off the oscillator power (closing switch U2C), and then measuring the voltage out of the control bridge. This is known as the ambient bridge voltage. To make this measurement, the following conditions are established: U8D and U2B are switched open, and U8A & C switch closed. Then, by using the DAC, U13, a successive approximation measurement of the voltage is made. Note that the output of the DAC is connected to one input of U4, and the bridge is connected to the other. Thus, it becomes a comparator that will make it possible for the computer to tell when the output voltage of the DAC is greater than the bridge voltage, and so complete the successive approximation. Once this is done, the DAC is set for 0V output, U8A is opened, U8B is closed, U8D and U2B are closed, and the track and hold capacitor, C39, will charge up to the voltage which represents the zero RF power condition of the bridge. When the oscillator is turned on by U9C, then the sampling switch, U2B, will open and allow C39 to supply this "RF Off" condition to the measuring circuit. Any voltage from the DAC will now reduce the amount of DC power being delivered to the thermistor bridge, and the control circuit will add just enough current to the oscillator to cause its output to add back that much RF power into the bridge.

Correction Thermistor Circuit

The compensation thermistor is mounted near CR13 to sense the temperature of the 20 dB attenuator section that is used to produce the 0 dBm output. This is the only absolute power specified. All other power levels are measured by the software relative to 0 dBm.

Calibrator NVRAM Control Circuit

The calibrator serial number and the correction constant for the 0 dBm output level, as well as the date of calibration and password for rewrite access, is contained in a Non-Volatile RAM. The read and write for it is provided by the parallel peripheral interface (PPI) U26. Before allowing access to the NVRAM, the software looks for a logic one on port A, bit zero of the PPI and, if that is present, it asks the operator for the password. If the correct password is supplied, then the collected data will be written into U18. If the jumper W1 is set to supply a logic 0 to the PPI, the operator will then have write access to U18 without needing a password.

Sensor NVRAM

Each sensor has a NVRAM which is used to store all of the calibration constants, the date of calibration, place of calibration, etc. This NVRAM is also password protected, but has no hardware switch to defeat it. The read/write control for it is furnished by U24A/B/C, U24D/E/F, Q2, and Q3. Q1 and Q8 control the 5V supply in order to reduce the amount of heat in the sensor, as well as reducing the noise from the supply.

Sensor Interrupt

Each time a sensor is connected or disconnected from the 58542, a CPU interrupt is generated by causing the thermistor voltage change to set a latch which signals the CPU that it needs to check for a sensor change. The latch is driven from a "window" comparator, U35D and U36A & B. This comparator is driven from capacitors which are connected to each of the thermistor lines from the sensors. The latch is enabled or cleared by a signal from the PPI, U26.

Digital Control Circuit

The digital control circuit is the interface between the CPU and the preceding functions.

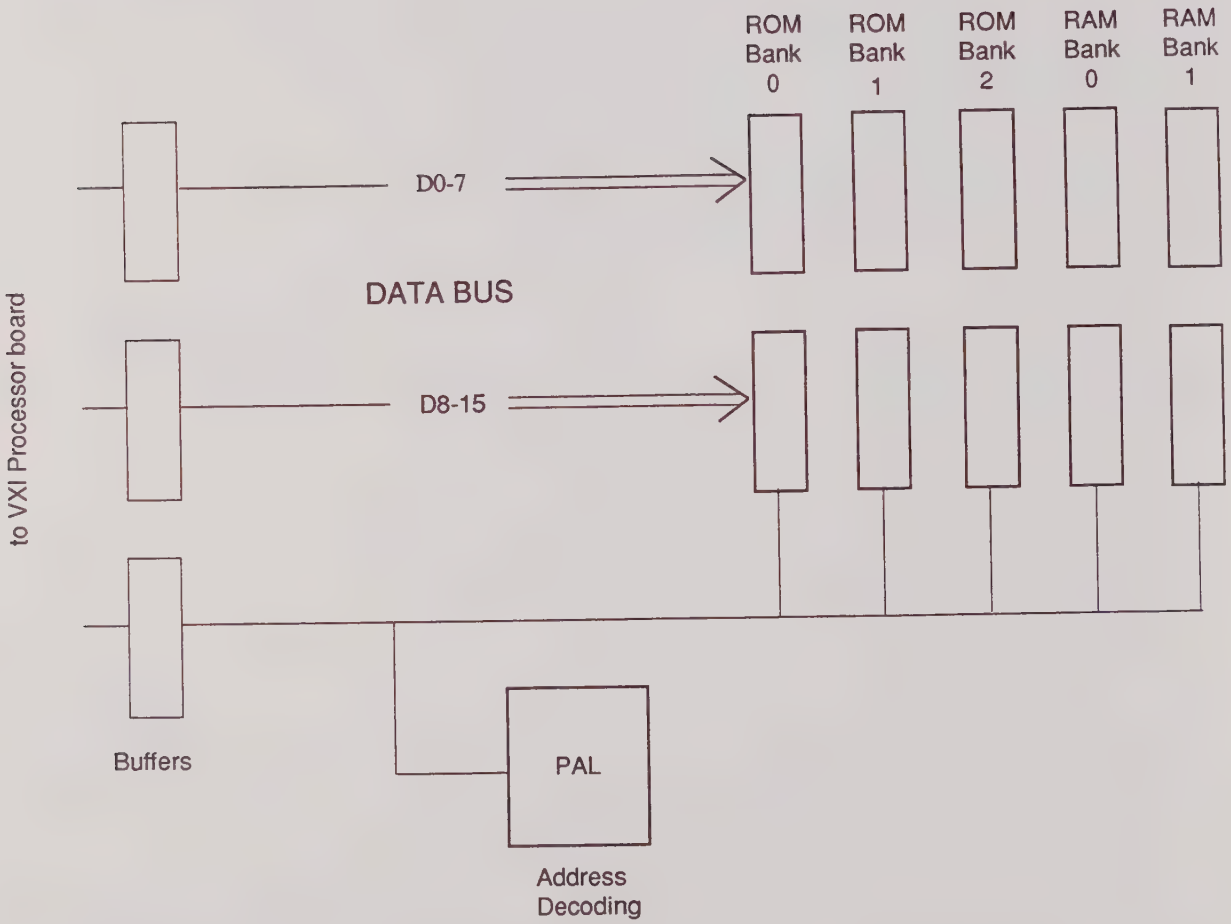


Figure 5-4. Digital PC Board Assembly (A2) Block Diagram

Digital PC Board (A2)

(Refer to Figure 5-4 on page 5-14 and SD 21357 Starting on page 7-17)

I/O address decoding is done first in the PAL (U10), and secondarily in U2. During valid I/O addressing, wait states are generated. The PAL monitors a clock cycle count (from U7A) to hold off DTACK on the CPU. W1 is jumpered to 4 wait states. During ROM and RAM accesses, the PAL asserts DTACK immediately with no wait states.

DTACK is passed back to the VXI Processor board. U12A is used to provide an open collector signal.

RAM bank 1 is connected to the battery. When power is lost, U6 de-selects RAM bank 1 and connects Vcc to the battery. This bank is then nonvolatile and can be used for data storage. C24 in parallel with the battery allows the battery to be replaced without losing data. R1 and TP1 & TP2 can be used to measure the current from the battery. At 2 μA, the voltage across the test points should measure about 2 mV.

U8 acts as an 8 bit input port addressed at CSTRG. This is used to monitor the eight TTL trigger lines on the VXI bus. The 58542 can trigger measurements either from these eight lines or from the TTL trigger BNC input on the front panel.

The Digital board interfaces with the Analog board via J1. All digital lines are buffered (U3, U4, and U5), and additional analog chip select decoding is done with U1.

U9A and U9B generate the upper data byte and lower data byte write signals. U11 buffers the R/*W and Reset signals.

W2 jumpers the three interrupt signals from the Analog board to the VXI Processor board. These jumpers should only be removed for troubleshooting.

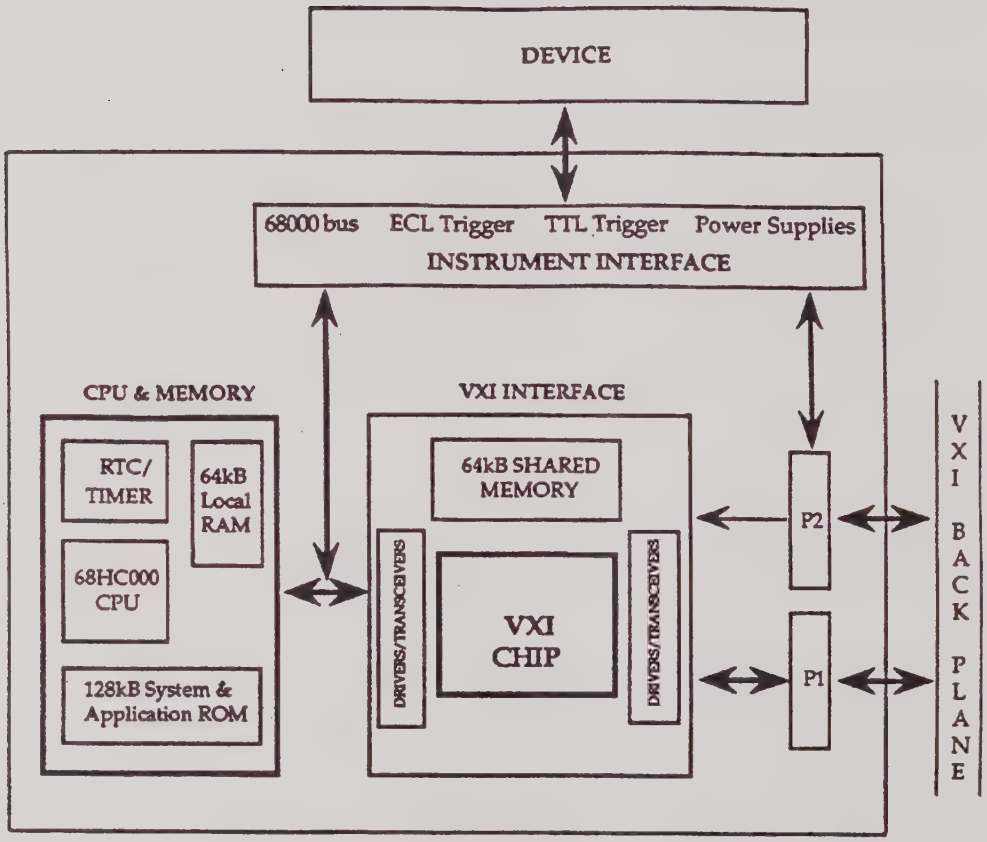


Figure 5-5. VXI Processor PC Board (A3) Block Diagram

VXI Processor PC Board (A3)

(See Figure 5-5 on page 5-16)

NOTE: The following circuit description is given for information only. The VXI Processor (and Memory) PC Boards are purchased as assemblies from another manufacturer. If these boards are not functioning properly the problem will usually be indicated by the instrument not being able to respond to an Identification query (*IDN? - see page 3-114). See page 8-1 for replacement instructions.

The VXI Processor PC Board circuit functions are divided into three main sections (shown on Figure 5-5). These three sections will be described in this discussion, and include the following:

- VXI Interface
- CPU and Memory
- LEDs and Drivers

VXI INTERFACE

This interface contains 64kB Shared Memory, a VXI interface gate array, and the drivers and transceivers that allow the VME and CPU to access the Shared Bus.

VXI Gate Array

U28 is a 120 pin gate array, packaged in a 13X13 pin grid array which implements the complete VXI Message Based Device interface in a single device.

The physical VXI A16 registers are located within this gate array. The gate array generates the necessary signals that control the flow of data from the processor section through the shared bus, and to the VXI bus, and vice versa.

The gate array also controls the LEDs that indicate whether the VXI is accessing the VXI A16 or the A24/A32 registers, and the FAIL LED which indicates whether the VXI A16 registers have been initialized.

Shared Memory

U29 and U30 are two 32K x 8 static RAM chips located on the Shared Bus for the development of VXI Shared Memory Protocols.

Shared Memory Decoders

U33 generates the necessary strobes and control signals to the Shared Memory static RAMs.

Drivers and Transceivers

U36 and U37 transceivers enable the data lines from the VXI bus onto the shared bus, and vice versa.

The address lines A1 through A15 are latched by U38 and U39 latching transceivers from the VXI bus onto the shared bus to implement address pipe-lining. The address lines are not latched going the other way.

The U40 transceiver buffers the address modifier lines.

The VXI chip controls the direction, and enables the transceivers.

U23 and U24 latch the processor data lines D00 to D15 to drive the upper 16 address lines of the VXI A32 space to implement A32 bus mastership.

The address lines A24 to A31 are buffered by U45 from the VXI bus P2 connector to the gate array.

U35 is a GAL which controls the direction of the data strobes, data transfer acknowledge, and the bus error from the VXI bus to the gate array and vice versa.

Logical Address Switch

U19 buffers the outputs of the address switch SW1 to allow the processor to read the logical address from the switch.

TTL Triggers and Local Bus

The TTL triggers and local bus are not used by the Processor board, but are made available to be used on the Digital board through the P7 pin connector.

PROCESSOR AND MEMORY

Processor

The Interface circuitry of the Processor board uses an 8 MHZ 68HC000 CMOS processor (U7). For further information on this chip see the latest Motorola data sheet.

Real Time Clock/Timer

U1 generates the system tick for a pSOS kernal operating system. It also adds time and event capabilities to the application code. For further information see the latest Hitachi 146818 data sheet.

Interrupt Controller

The processor uses seven levels of auto vectored interrupts. U6 encodes the priority levels for the processor. Three levels of auto vectored interrupts are available to the user. These are signals AVINT4, AVINT3, and AVINT2. The higher numbered interrupt signal has the higher priority. The user accesses these signals from the P5 pin connector on the Processor board.

Bus Error Timer

U2A divides down the VXI 16 MHz clock for the 8 MHz processor. U2B is used to generate a bus error signal if timeout occurs before data transfer acknowledgement. The timer generates this signal if a processor access cycle exceeds 16 microseconds.

Local Address Decoders

U17 and U18 are address decoding GALs. These circuits generate the chip selects and the control lines for access to the RAM, ROM, and other functions.

Drivers and Transceivers

U26 and U27 transceivers drive the local data from the processor bus to the shared bus, and vice versa.

The processor address lines are driven by U21 and U22 to the shared bus.

The VXI gate array, U28, enables these buffers.

Local Memory

U9 and U11 are two 32K X 8 static RAM chips on the processor bus.

LED DRIVERS

The actual LEDs are located on the Analog PC Board. U32 is a one-shot used to widen the pulse of the VME A16 and A24/A32 signals. U34 is used to drive the RUN, HALT, MODID, A16 and A24/A32 LEDs. The FAIL LED is driven directly from the VXI chip. The TRIGGER LED is driven under software control.

CHAPTER 6

MAINTENANCE

INTRODUCTION

This section of the manual defines maintenance practices and calibration and troubleshooting checks that can be used to assist in fault isolation.

It should be remembered that problems can occur that might be produced by equipment or components peripheral to the 58542 power meter. Preliminary checks should be made to be sure that external equipment or components are not causing what appears to be a malfunction within the instrument.

PERIODIC MAINTENANCE

The maintenance and calibration procedures given in this chapter should be performed at least once each year unless the power meter is operated in an extremely dirty or chemically contaminated environment, or is subject to severe abuse (such as being dropped). In such cases, more frequent maintenance (immediate, if the unit is dropped or severely abused in some way) is required.

A. The front panel and housing of the unit can be cleaned using a cloth dampened in a mild detergent. Do not use abrasive cleaners, scouring powders, or any harsh chemicals. Wipe the soap residue off with a clean, damp cloth, then dry with a clean dry cloth.

B. Make a performance verification check in accordance with the procedures given in Chapter 4, PERFORMANCE VERIFICATION TESTS, of this manual. If the unit will pass all of the performance tests, there is no need for calibration.

CALIBRATION PROCEDURES

Calibrator Output Power

Perform the Calibrator Output Power Reference Level check starting on page 4-4 of the PERFORMANCE VERIFICATION TESTS chapter of this manual. If the unit fails to meet the power output specification within the 0.981 mW to 1.019 mW minimum and maximum limits, then proceed with the following steps:

A. To correct the setting of the power output of the calibrator, you must know the password if it has been set, or you must defeat it by setting jumper A1W1 to position A. (This jumper is located and indicated on the Analog PC Board. You can also check Figure 7-1 on page 7-4 of the SCHEMATIC DIAGRAMS chapter for the jumpers location on the board.) If no password has been set, you can proceed with the jumper in position B. Calculate the percent error in power (as described in the Performance Verification Linearity check starting on page 4-6), and change the CALFAC by that amount. For example, if the power output is low by 0.5% then increase the CALFAC by that amount.

B. Shown below is a sample program (written in Turbo-Basic) that can be used to set the Calibrator correction. After this program has been run, the password enable link, A1W1, can be set to "B" and a password assigned.

```
PRINT    "IT IS NECESSARY TO DEFEAT PASSWORD PROTECTION TO DO THIS TASK."
INPUT    "IS THE PASSWORD PROTECTION TURNED OFF (W1 ON POSITION A)";A$
PRINT:PRINT  "Connect the Power Meter sensor to the DUT calibrator output."
INPUT    "Press ENTER when ready to set the calibrator correction";A$
print
    MEAS ROUTINE TURNS ON THE CALIBRATOR, MEASURES THE POWER OUTPUT IN mW AND
    CALCULATES CAL FACTOR AND TURNS THE CALIBRATOR OFF AGAIN.  SENDIT ROUTINE
    SENDS THE STRING C$ TO THE DUT.

Fields in the CALFAC from EEPROM? : calfac, sernum, min, hr, day, mo, yr, enab, pswd
Note that the password is not sent.  "enab" is the password enable bit.
        C$ = "DIAG:CAL:EEPROM?"
        GOSUB SENDIT                          ! Send the command
        GOSUB DAT                             ! GET THE EEPROM DATA
                                              ! TO PROCESS IN R$
        PRINT R$                              ! SEE FIELDS ABOVE
        LAST = 1
        FOR 1=1 TO 8P=INSTR(LAST,R$,",")      ! Separate the result into array elements
        IF P=0 THEN B$[I] = MID$(R$,LAST):ELSE B$[I]=MID$(R$,LAST,P-LAST)
        LAST=P+1
```

```
        NEXT I                                          ! Now the data fields have been put into an array B$
        B$[8] = "0"                                     ! DISABLE THE PASSWORD
        C$ = *CLS                                       ! Clear the status byte
        GOSUB SENDIT
        B$[1] = "100.00"                                ! SET THE CAL FACTOR TO 100%
        GOSUB MKCS                                      ! MAKE THE STRING TO SEND TO THE DUT
        GOSUB SENDIT
        C$ = "*ESR?"
        GOSUB SENDIT
        GOSUB DAT:PRINT "EVENT STATUS IS: ";R$  ! MUST BE 0
        PRINT
            ! PRINT      "Connect the Power Meter sensor to the DUT calibrator output."
            ! INPUT      "Press ENTER when ready to set the calibrator correction";A$
        GOSUB MEAS      "MEASURE POWER OUTPUT IN mW AND RETURN CAL FACTOR IN %"
        B$[1] = STR$(INT(100*CF)/100)                   ! CF IS CAL FACTOR
        PRINT:PRINT   "CAL CORRECTION IS :";B$[1]
        INPUT  "ENTER THE SERIAL NUMBER";B$[2]
        INPUT  "ENTER THE TIME AS H,M"[4],B$[3]
        INPUT  "ENTER THE DATE AS M,D,Y (e.g. 5,9,93)";b$[6],b$[5],b$[7]
        C$ = "*CLS"                                     ! CLEAR THE STATUS BYTE
        GOSUB SENDIT
        GOSUB MKCS                                      ! CONVERT THE NEW DATA
        GOSUB SENDIT                                    ! SEND TO DUT (did it understand and execute properly?)
        C$ = "*ESR?"
        GOSUB SENDIT
        GOSUB     DAT:PRINT     "EVENT STATUS IS: ";R$   ! MUST BE 0
        GOSUB MEAS                                      ! VERIFY THAT THE POWER OUTPUT IS NOW
                                                        ! CORRECT
        END

MKCS:                           ! CONVERT THE ARRAY TO A STRING OF COMMA SEPARATED VALUES
C$ = "DIAG:CAL:EEPROM"
FOR I =  1 TO 8:C$=C$+B$[I]:IF I <8 THEN C$=C$+",":NEXT I
C$=C$+",000000"                                         ! APPEND THE DEFAULT PASSWORD
PRINT:PRINT   "EEPROM DATA:";C$
RETURN

MEAS:
C$ = "OUTP:ROSC ON"                                     ! Turn on the Calibrator
GOSUB SENDIT
INPUT  "Enter the power output in mW";m                 ! Enter the measured power here either by a call to a
                                                        ! subroutine or from the keyboard
CF = 100/m:print "The power is ";m
C$ = "OUTP:ROSC OFF
GOSUB SENDIT                                            ! Turn off the calibrator
Return
```

C. The sensor(s) can now be calibrated by connecting to the calibrator output and entering the command **"CAL1** (or 2)" If the calibration does not complete satisfactorily, refer to the calibrator voltage and frequency checks starting on page 6-5.

D. The Linearity test can now be performed as detailed on page 4-6 of Chapter 4. This is a complete procedure, and must be performed in the exact order given to produce accurate results. If this test fails, try it again with a different sensor. If it still fails, refer to the calibrator voltage and frequency checks given starting on page 6-5.

The following tests require that the power meter's side cover be removed. To remove the side cover, remove the two flat head screws from the right side cover, slide the cover to the rear about 1/4 inch, and lift it off.

The same test equipment that was used for the Performance Verification Tests can be used for these tests.

Refer to the Analog PC Board description on page 5-5 of the ELECTRICAL DESCRIPTION chapter for further help in defining the problem. If the fault cannot be located to the component level, the PC board can be removed and replaced with a different one with no further calibration required except to set the calibrator output power to 0 dBm

Battery

(See the Lithium Battery Replacement procedure Addendum on page 6-9)

The power meter contains a 3.6V lithium battery to maintain the data pertaining to all of the instrument's test setups and calibration information when the unit is turned off. This battery should last in excess of five years. To check the battery, connect a voltmeter between A2TP1 and the frame of the instrument. (See Figure 7-2 on page 7-16 of the SCHEMATIC DIAGRAMS chapter for the location of this test point, if necessary.) If the voltage is less than 3.1V, the battery should be replaced. This can be done without losing the data stored in the RAMs if the old battery is removed and the new battery installed in less than 10 seconds with mains power off, or if power is left on while changing the batteries.

Power Supply Voltage Checks

There are 6 power supplies in the power meter. These are all located on the Analog PC Board (A1). In case there is a regulated voltage failure, check the corresponding unregulated supply referencing SD 21360 on page 7-5 of the SCHEMATIC DIAGRAMS chapter. The unregulated voltage must be at least 2 volts more than the required regulated output. To measure the supplies, turn the unit on and let it stabilize for a minute or so. Then proceed as follows:

1. Connect the DVM from A1TP3 (ground) to A1TP2 (+). (A1 is the Analog PC Board.) Measure +14.25V to +15.75V.

2. Connect the high side of the DVM to A1TP4. Measure -14.25V to -15.75V.

3. Connect the high side of the DVM to A1TP5. Measure +4.75V to +5.25V.

4. Connect the high side of the DVM to A1TP9. Measure +11.4V to +12.6V.

5. Connect the high side of the DVM to A1TP10. Measure -11.4V to -12.6V.

6. Connect the high side of the DVM to A1U14, pin 1. Measure -9.1V to -10.9V.

Calibrator Voltages

To measure the calibrator voltages, first make sure that neither side of the DVM is grounded. The following measurements should find most of the problems that can arise in the calibrator circuitry.

1. Connect the DVM across the large resistor, A1R174. Measure 0.4 to 0.9 volts depending on the room temperature and how long the unit has been operating. This voltage is proportional to the current in the thermistor heater transistor which maintains the calibrator thermistor in a 60°C (140°F) environment. The voltage measured in the next step is dependent on this being correct.

NOTE: The exact ambient temperature and power-on time of the instrument mentioned in Step 1 are not specific factors, but do have some effect on the reading taken across A1R174. If there is a problem in the circuit, the measured voltage will usually be some amount way outside of the 0.4 to 0.9 volt spec (such as 0 volts or +4 or 5 volts).

2. Connect the low side of the DVM to A1TP3 and the high side to A1TP1. Measure +7 to +8.5 volts. This is the voltage applied to the thermistor bridge that is used to measure the calibrator power. This voltage will vary as the calibrator provides different amounts of RF power. This measurement assumes that the calibrator is OFF. To verify that the calibrator is off, send **"OUTP:ROSC OFF"**

3. Turn the calibrator ON by sending **"OUTP:ROSC ON"** Now connect the high side of the DVM to A1U3, pin 7. Measure +2 to +11 volts which should change less than 2 mV per minute. It the voltage is incorrect or drifts excessively, troubleshoot the sample and hold circuit surrounding A1U3A.

Calibrator Frequency Check

To measure the frequency of the calibrator:

1. Connect a 50 MHz counter to the calibrator output connector.
2. Turn ON the calibrator according to the procedure given in Step 3, above.
3. Measure 49 to 51 MHz.
4. Turn OFF the calibrator by sending **"OUTP:ROSC OFF".**

GPIB Test Functions

If the unit will not calibrate its sensors, there are some test functions available through the GPIB. Using these functions, it is possible to check out the operation of the different parts of the calibrator system.

1. If the calibrator output power as measured in the Performance Verification Test is within tolerance but the unit will still not complete a sensor calibration, perform the following test to determine if the calibrator is operating correctly:

   a. Send **"DIAG:CAL:SOUR 10"** from the controller, followed by **"DIAG:CAL:ATTEN 0".**

   The calibrator output should be +20 dBm ±0.8 dB.

   b. Send **"DIAG:CAL:ATTEN 10".**

   This will insert the 10 dB attenuator into the calibrator output. The power should measure a decrease of 10 dB ±1 dB.

   c. Repeat Step b, substituting "20", "30", and "40" successively in the command.

   The power should be attenuated by the attenuation level specified in the command ±1 dB. This will verify the health of all of the attenuators.

2. The next step is to verify the oscillator power control circuits. This is done by setting the power to higher and lower levels and measuring the results.

    a. Send the command **"DIAG:CAL:ATTEN 0"**, followed by **"DIAG:CAL:SOUR X"** where X is -3 to +13. The resulting power output should range between -13 dB from the first reading taken in Step 1.a to at least +21 dBm.

This checks the calibrator control circuits completely. If the unit still will not calibrate a sensor the problem is in the measurement circuits, not the calibrator. Proceed to the next heading.

58542 Channel 2 Troubleshooting

If only one channel will calibrate, troubleshoot the circuits associated with the channel that fails. The separate channels are shown on Sheet 1 (Ch 2) and Sheet 2 (Ch 1) of SD 21360 on pages 7-5 and 7-7 of the next chapter. For example, if the unit will calibrate channel 1 but not channel 2, proceed as follows:

1. If the unit fails to light the "TRIGGER" LED when the sensor is connected the problem lies in the temperature sensing thermistor circuit which connects to U39, pin 3.

    a. Measure the voltage at U5, pin 12. It should be about 2 or 3 volts. If it is above 5 or below 0.3 volts, the thermistor circuit is faulty.

2. Try reversing the two sensors to determine if one of them is bad.

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ADDENDUM

LITHIUM BATTERY REPLACEMENT (Recommended every three years)

CAUTION: The following information describes a replacement procedure for the lithium battery in the 58542 Power Meter. Since this procedure requires removing the cover from the instrument and then restoring power ***before*** removing the battery, this procedure should only be performed by qualified personnel.

Lithium batteries can supply substantial current and, depending on factors such as the state of charge, can overheat when shorted.

Information on testing the new battery is given in the last paragraph of this Addendum on the next page. The following replacement procedure is intended for users knowledgeable in the use and care of equipment using non-rechargeable lithium batteries.

The 58542 uses a lithium battery to maintain power to the static RAM used to store instrument data such as sensor linearity tables, power down status, and stored setups.

Battery life varies depending on the usage of the 58542 instrument but will be at least three years assuming normal daily use of the instrument. To save possible inconvenience that can be caused by the unintentional loss of data in the volatile memory of the 58542, it is recommended that the lithium battery be replaced every three years or when the terminal voltage drops below 3.1V.

If the instrument is to be placed in long term (2 years or more) storage, the battery should be removed.

Recommended Replacement Battery: Tadiran Type TL-5242
Giga-tronics Part Number 21212

58542 LITHIUM BATTERY REPLACEMENT PROCEDURE:

1. Turn OFF the 58542.
2. Remove the cover.
3. Turn ON the 58542 (to maintain memory power while replacing the battery).
4. Note the orientation of the battery which is located on the side of the analog input coved. The battery is held in place with a "hook and loop" fastener. Peel the battery free of the PC board.
5. Disconnect the battery wires. The connector is polarized so it can only be inserted one way, with the red wire toward the rear of the instrument.

6. Install the new battery and connect the wires.

7. Turn OFF the 58542 and measure the battery voltage between TP13 (com) and TP17 (bat). It must be at least 3.6V.

8. Connect a voltmeter between A2TP1 & TP2. The voltage must settle to <3 mV. If above this level, the battery life will be shortened. The only load on the battery is the static RAM. It might be necessary to find out which chip is drawing too much current, and replace it if the current is excessive.

9. Replace the cover and secure.

10. If desired, a label can be attached indicating when the next battery replacement is due.

This completes the replacement procedure.

To test for satisfactory operation of the new battery, turn ON the 58542, calibrate a sensor, turn the 58542 OFF, wait ten seconds, and turn the 58542 instrument back ON. The sensor calibration should still be valid as indicated by proper measurement of a power level.

Appendix B

Diagnostic Commands Used for Testing the Model 58542 Power Meter

NOTE: This Apppendix lists the VXI Diagnostic commands used for testing and adjusting the Model 58542 VXI Power Meter. A typical example is shown with the basic command format. These commands are undocumented factory diagnostic and engineering functions. Some commands are described in the maintenance/calibration section.

Prior to using these diagnostic commands it is necessary to disable channels 1 and 2 from taking measurements. This is done by sending the following commands:

```
CALC1:STAT OFF
CALC2:STAT OFF
```

Command Syntax Typical Example	Function
DIAGnostic:ADC? **OUTPUT @Pwr_Mtr;"DIAG:ADC?"**	! Query analog to digital converter reading (return: 0 to 32767)
DIAGnostic:AVADC?*space***16** **OUTPUT @Pwr_Mtr;"DIAG:AVADC? 16"**	! Query analog to digital reading with 16 average (average from 1 to 512) (return: 0 to 32767)
DIAGnostic:AVOLT?*space***16** **OUTPUT @Pwr_Mtr;"DIAG:AVOLT? 16"**	! Query analog to digital reading in volts with 16 average (average from 1 to 512) (return: 0 to 10)
DIAGnostic:BNC:ANAlog*space***5.5** **OUTPUT @Pwr_Mtr;"DIAG:BNC:ANA 5.5"**	! Set analog bnc port output to 5.5 volts (-10 to 10)
DIAGnostic:BNC:TRIGger? **OUTPUT @Pwr_Mtr;"DIAG:BNC:TRIG?"**	! Query EXT trigger input high, 5V, or low, 0.0V, status ("1" = triggered; "0" = no trigger)
DIAGnostic:BNC:VPROpf? **OUTPUT @Pwr_Mtr;"DIAG:BNC:VPRO?"**	! Query VpropF port reading (0 to 32767)
DIAGnostic:CALibrator:ATTenuator*space***10** **OUTPUT @Pwr_Mtr;"DIAG:CAL:ATT 10"**	! Set calibrator attenuator to 10 dB (0 to 40)
DIAGnostic:CALibrator:ATTenuator? **OUTPUT @Pwr_Mtr;"DIAG:CAL:ATT?"**	! Query calibrator attenuator value
DIAGnostic:CALibrator:EEPROM*space***100** **OUTPUT @Pwr_Mtr;"DIAG:CAL:EEPROM 1800123,30,9,23,6,92,0,123456"**	! Set calibrator eeprom data: cal fac, s/n, min, hr, ! day, month, yr, password flag(0:disable, ! 1:enable), password

Command Syntax Typical Example	Function
DIAGnostic:CALibrator:EEPROM? **OUTPUT @Pwr_Mtr;"DIAG:CAL:EEPROM?"**	! Query calibrator eeprom data
DIAGnostic:CALibrator:POWer*space***-23.5** **OUTPUT @Pwr_Mtr;"DIAG:CAL:POW -23.5"**	! Set calibrator power to -23.5 dBm
DIAGnostic:CALibrator:PTEMperature? **OUTPUT @Pwr_Mtr;"DIAG:CAL:PTEM?"**	! Query calibrator temperature (in centigrade)
DIAGnostic:CALibrator:SOURce*space***9.5** **OUTPUT @Pwr_Mtr;"DIAG:CAL:SOUR 9.5"**	! Set calibrator internal power to 9.5 dBm (power output in dBm assuming perfect 10 dB pad)
DIAGnostic:CALibrator:VAMB? **OUTPUT @Pwr_Mtr;"DIAG:CAL:VAMB?"**	! Query calibrator bridge volts (0 to 10)
DIAGnostic:CTABle?*space***<sensor 1 or 2>** **OUTPUT @Pwr_Mtr;"DIAG:CTAB? 1"**	! Query sensor 1 calibration data
DIAGnostic:GAIN*space***A-B,0-1,-2-3-4-5-6,N-I-G-O** **OUTPUT @Pwr_Mtr;"DIAG:GAIN"**	! Set gain circuit; Channel, Gain, Mode ! A,B channel, Gain 0 to 6 ! N: non_invert, I: invert, G: ground, O:option
DIAGnostic:LED*space***ON-OFF** **OUTPUT @Pwr_Mtr;"DIAG:LED ON"**	! Turn trigger led on
DIAGnostic:MULtiplexer*space***MA-MB-MC .... MO-MP** **OUTPUT @Pwr_Mtr;"DIAG:MUL MA"**	! Set multiplexer
DIAGnostic:MEASurement*space***STARt-STOP** **OUTPUT @Pwr_Mtr;"DIAG"MEAS STAR"**	! Resume measurement process
DIAGnostic:OFFSet*space***3.5** **OUTPUT @Pwr_Mtr;"DIAG:OFFS 3.5"**	! Set ADC offset to 3.5 volts (-5 to +5)
DIAGnostic:RAM? **OUTPUT @Pwr_Mtr;"DIAG:RAM?"**	! Query ram destructive test result ("0" = pass; "1" = fail)
DIAGnostic:ROM? **OUTPUT @Pwr_Mtr;"DIAG:ROM?"**	! Query rom test result ("0" = pass; "1" = fail)
DIAGnostic:RAWdata*space***<ON or OFF>** **OUTPUT @Pwr_Mtr;"DIAG:RAW ON"**	! Enable measurement raw data output
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:READ **OUTPUT @Pwr_Mtr;"DIAG:SENS1:READ"**	! Read eeprom table data from sensor 1 into ! editor memory

Command Syntax Typical Example	Function
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:WRITe 123456 **OUTPUT @Pwr_Mtr;"DIAG:SENS1:EEPROM:WRIT 123456"**	! Write eeprom sensor 1 editor data into ! sensor (using password)
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:TYPE 80301,0,59,9,22,12,92,0 **OUTPUT @Pwr_Mtr;"DIAG:SENS2:TYPE 80301,0,59,9,22,12,92,0**	! Edit sensor 2 eeprom type table data: ! model, S/N, cal location, min, hour, day, ! month, year, password flag (0:disable, ! 1:enable)
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:SPEC 1e7,18e9,4100,3900 **OUTPUT @Pwr_Mtr;"DIAG:SENS2:SPEC 1e7,18e9,4100,3900**	! Lower frequency, upper frequency ! video R+,R-
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:TYPE? **OUTPUT @Pwr_Mtr;"DIAG:SENS1:EEPROM:TYPE?"**	! Query sensor 1 eeprom type table data
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:CORRection **OUTPUT @Pwr_Mtr;"DIAG:SENS1:EEPROM:CORR 1.1,2.1,3.1,4.1,5.1,6.1,7"**	! Edit sensor 1 eeprom correction table: ! A,B,C,D,E,H
DIAGnostic:SENS<sensor 1 or 2>:EEPROM CORRection? **OUTPUT @Pwr_Mtr;"DIAG:SENS1:EEPROM:CORR? "**	! Query sensor 1 eeprom correction table
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:CALFRange 2e9,1e9,17,1 **OUTPUT @Pwr_Mtr;"DIAG:SENS1:EEPROM:CALFR 2e9,1e9,17,1"**	! Edit sensor 1 eeprom cal factor range ! table:standard:start cf freq, step cf freq, ! cf number, special cf number
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:CALFRange? **OUTPUT @Pwr_Mtr;"DIAG:SENS1:EEPROM:CALFR?"**	! Query sensor 1 eeprom cal factor range table
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:FREQSTandard? **OUTPUT @Pwr_Mtr;"DIAG:SENS1:EEPROM:FREQST?"**	! Query sensor 1 eeprom cal factor standard ! freq table
DIAGnostic:SENS<sensor 1 or 2>:EEPROM:FREQSPecial? **OUTPUT @Pwr_Mtr;"DIAG:SENS1:EEPROM:FREQSP?"**	! Query sensor 1 eeprom cal factor special ! freq table

Command Syntax
Typical Example **Function**

DIAGnostic:SENS<sensor 1 or 2>:EEPROM:FREQSPecial*spacedouble quote***one or more frequencies 1e7 to 40e9***double quote***
OUTPUT @Pwr_Mtr;"DIAG:SENS1:EEPROM:FREQSP ""1e9,2.2e9"""""
! Add special cal factors at 1 GHz and 2.2 GHz

DIAGnostic:SENS<sensor 1 or 2>:EEPROM:CALFSTandard?
OUTPUT @Pwr_Mtr;"DIAG:SENS1:EEPROM:CALFST?"
! Query sensor eeprom cal factor standard table

DIAGnostic:SENS<sensor 1 or 2>:EEPROM:CALFSTandard "0.20,0.30,0.40,0.50,0.60, 0.70,0.80,0.90,0,0.10,0.11,0.12,0.13,0.14,0.15,0.16,0.17,0.18"
OUTPUT @Pwr_Mtr;"DIAG:SENS1:CALFST 0.20,0.30,0.40,0.50,0.60,0.70,0.80, 0.90,0,0.10,0.11,0.12,0.13,0.14,0.15,0.16,0.17,0.18"
! Edit sensor 1 eeprom cal factor standard table:
! 2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18
! Standard Cal Factor frequencies. Match Start,Step and #.

DIAGnostic:SENS<sensor 1 or 2>:EEPROM:CALFSPecial*spacedouble quote***one or more calfactor values-99.9 to 9.99***double quote***
OUTPUT @Pwr_Mtr;"DIAG:SENS1:EEPROM:CALFSP ""0.03,-0.04"""""
! Added sensor 1 cal factors, # of items matches # of Frequencies

DIAGnostic:SENS<sensor 1 or 2>:EEPROM:CALFSPecial?
OUTPUT @Pwr_Mtr;"DIAG:SENS1:EEPROM:CALFSP?"
! Query sensor 1 special frequency cal factor

DIAGnostic:SENVolt*space***<ON or OFF>**
OUTPUT @Pwr_Mtr;"DIAG:SENV ON" ! Turn on sensor 5 volt line

DIAGnostic:VOLT?
OUTPUT @Pwr_Mtr;"DIAG:VOLT?" ! Query ADC reading in volts

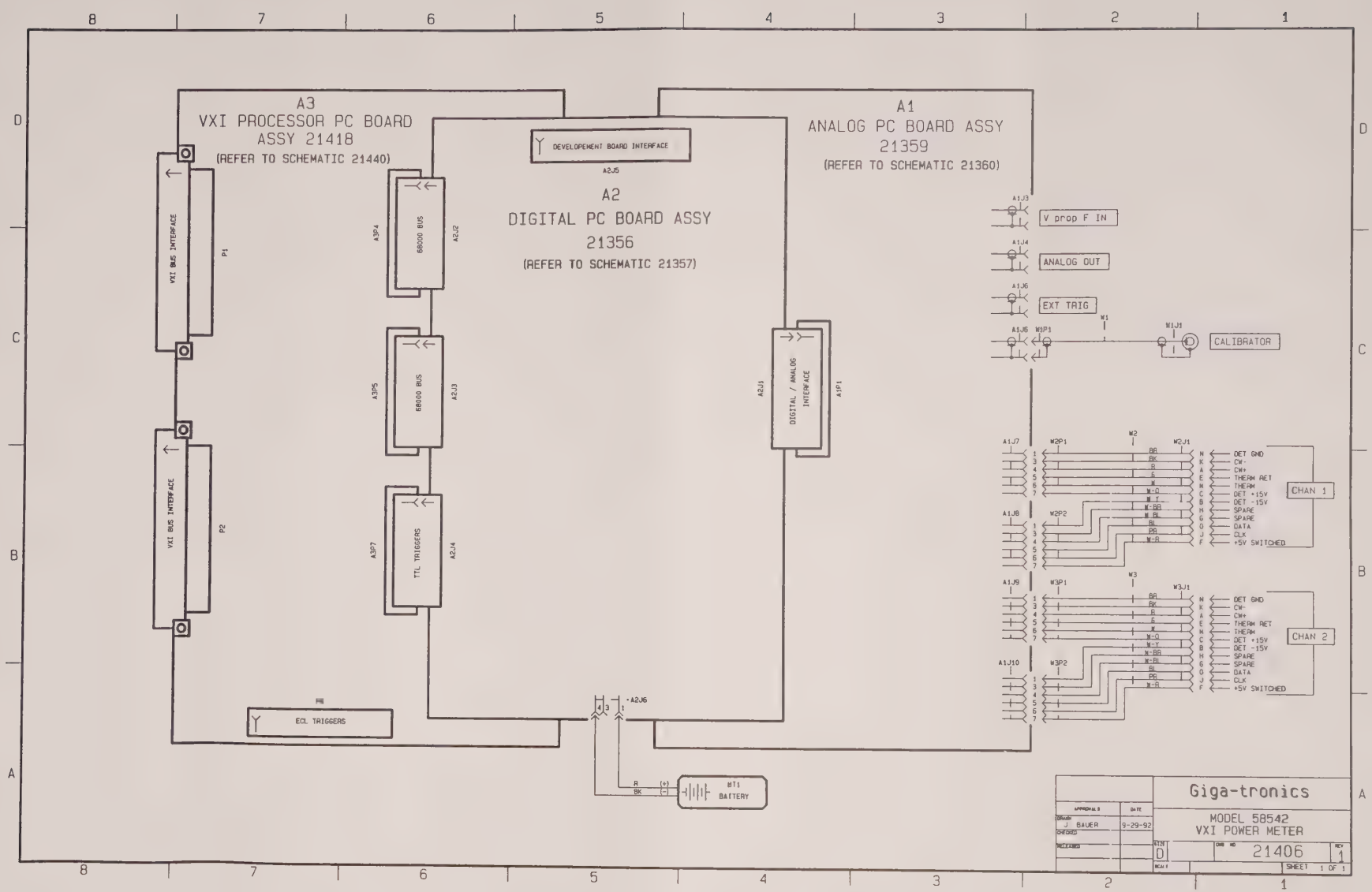
DIAGnostic:ZTABle?*space***<sensor 1 or 2>**
OUTPUT @Pwr_Mtr;"DIAG:ZTAB? 1" ! Query sensor 1 zeroing data

CHAPTER 7

SCHEMATIC DIAGRAMS (SD) AND ASSEMBLY DRAWINGS

(PC Board Component Part Locations)

Reference Designation		Drawing Number	Page Number
	58542 VXI Power Meter SD	21406	7-3
A1	Analog PC Board Assembly Dwg. (Figure 7-1)	21359	7-4
	Analog PC Board SD (6 Sheets)	21360	7-5
A2	Digital PC Board Assembly Dwg. (Figure 7-2)	21356	7-16
	Digital PC Board SD (2 Sheets)	21357	7-17


A3
VXI PROCESSOR PC BOARD
ASSY 21418
(REFER TO SCHEMATIC 21440)
VXI BUS INTERFACE
P1
VXI BUS INTERFACE
P2
A3P4
68000 BUS
A2J2
A3P5
68000 BUS
A2J3
A3P7
TTL TRIGGERS
A2J4
DEVELOPEMENT BOARD INTERFACE
A2J5
A2
DIGITAL PC BOARD ASSY
21356
(REFER TO SCHEMATIC 21357)
A2J1
DIGITAL / ANALOG INTERFACE
A1P1
A1
ANALOG PC BOARD ASSY
21359
(REFER TO SCHEMATIC 21360)
A1J3
V prop F IN
A1J4
ANALOG OUT
A1J6
EXT TRIG
W1
W1J5
CALIBRATOR
A1J7
W2
W2P1
W2J1
DET GND
CW-
CW+
THERM RET
THERM
DET +15V
DET -15V
SPARE
SPARE
DATA
CLK
+5V SWITCHED
CHAN 1
A1J8
W2P2
A1J9
W3
W3P1
W3J1
CHAN 2
A1J10
W3P2
ECL TRIGGERS
A2J6
BT1
BATTERY
Giga-tronics
MODEL 58542
VXI POWER METER
J BAUER
9-29-92
21406
SHEET 1 OF 1

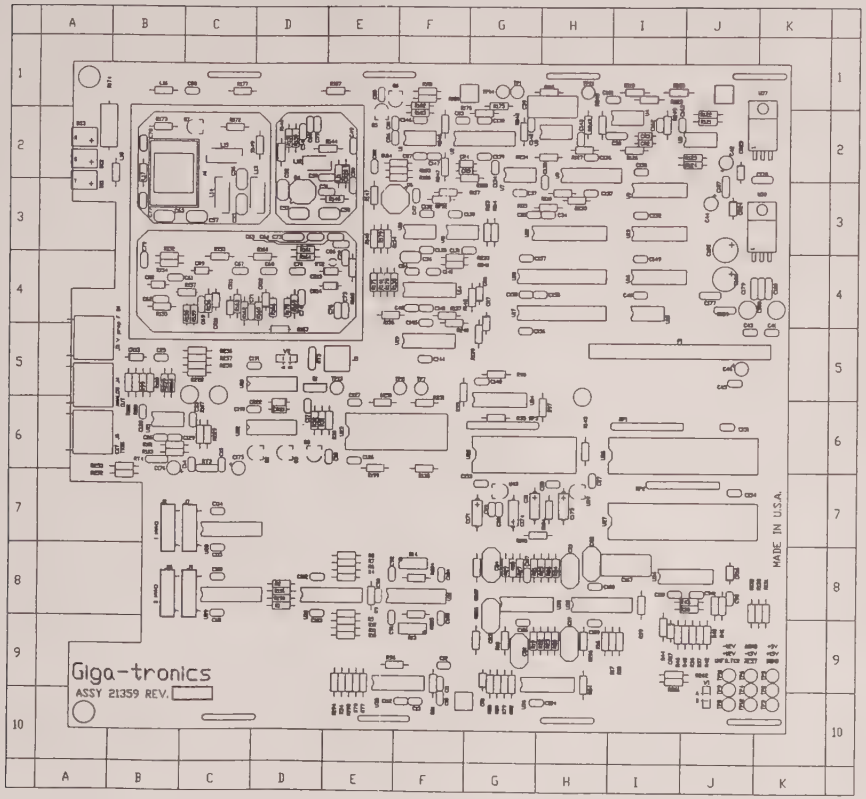
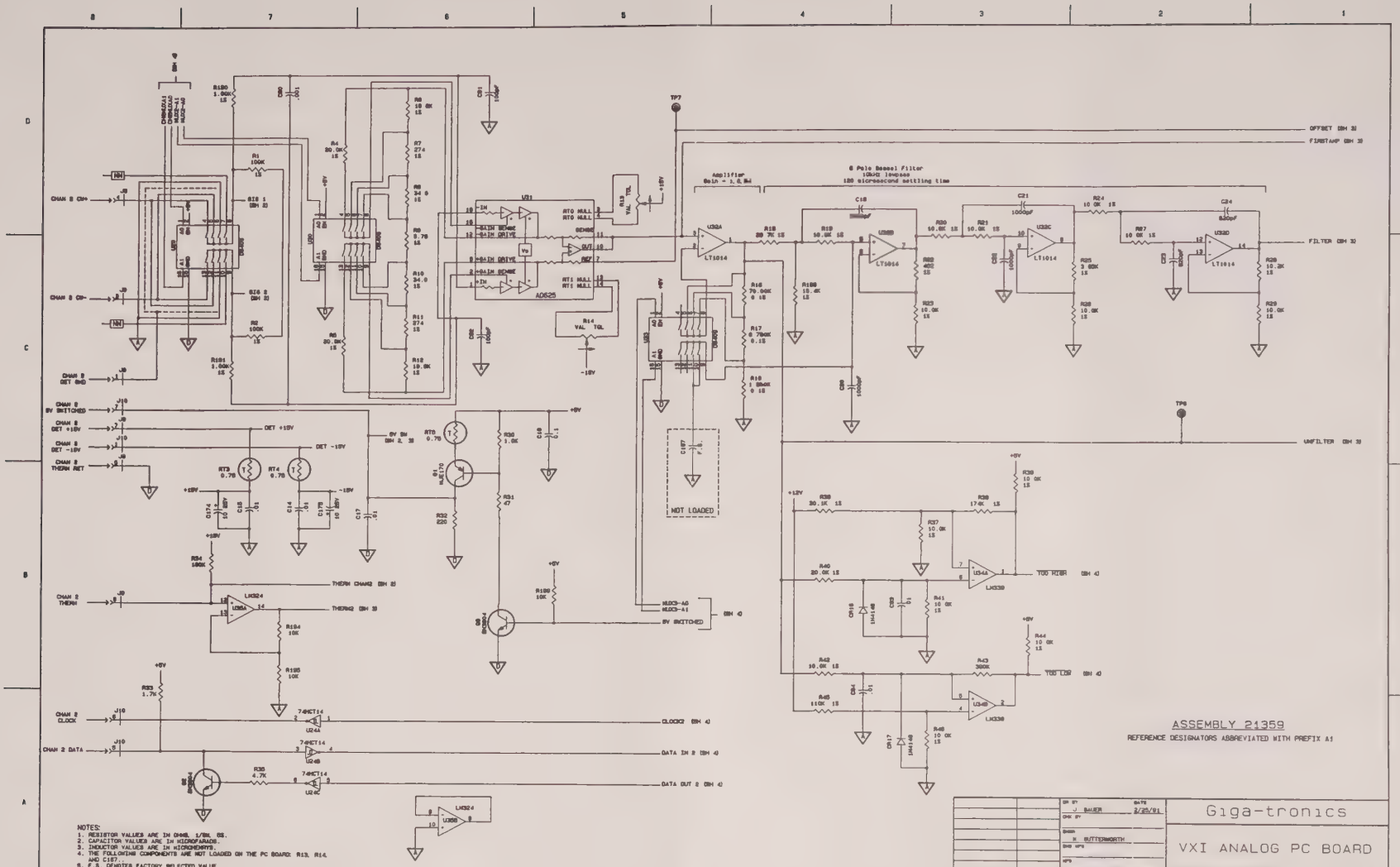
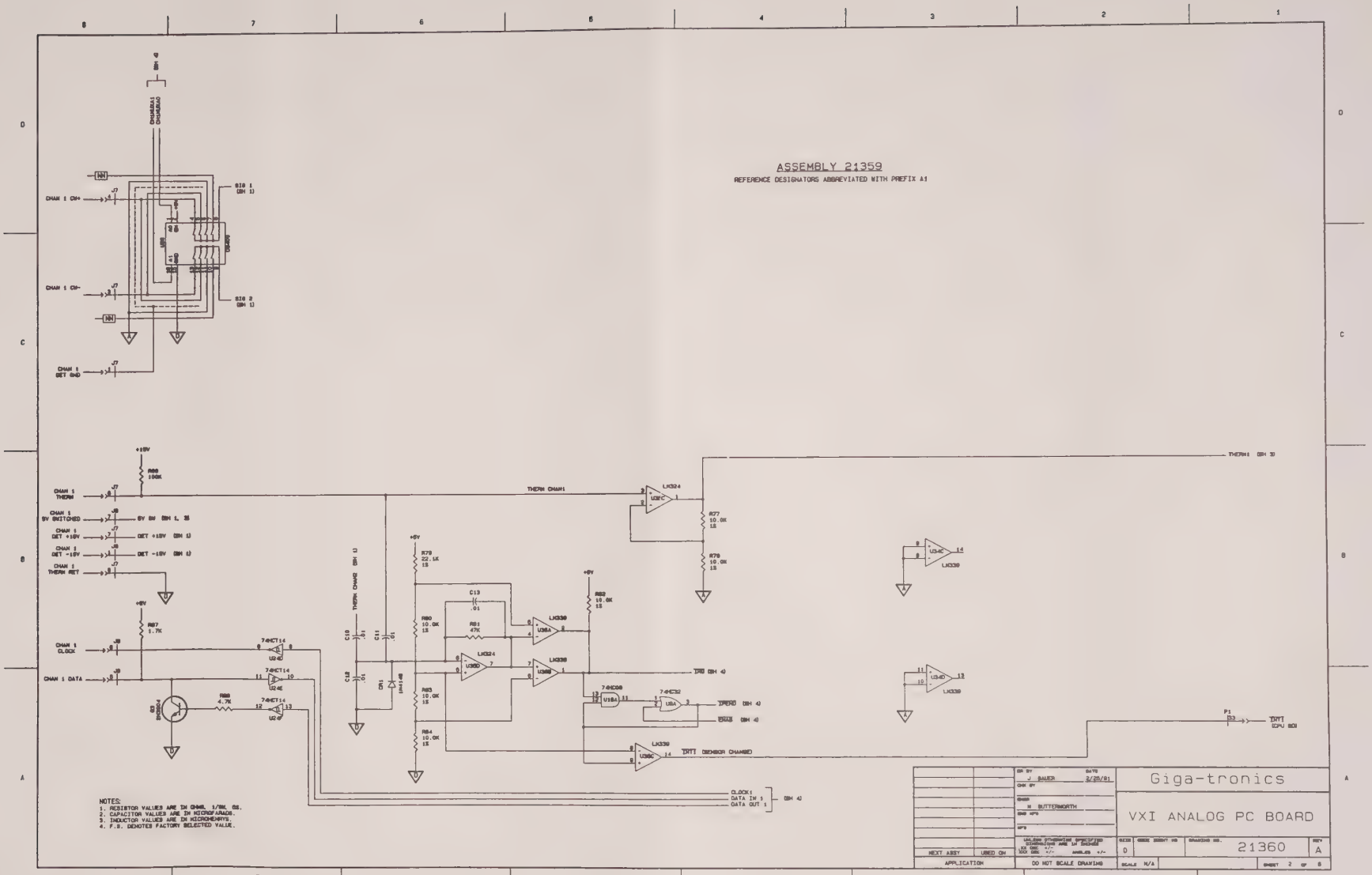


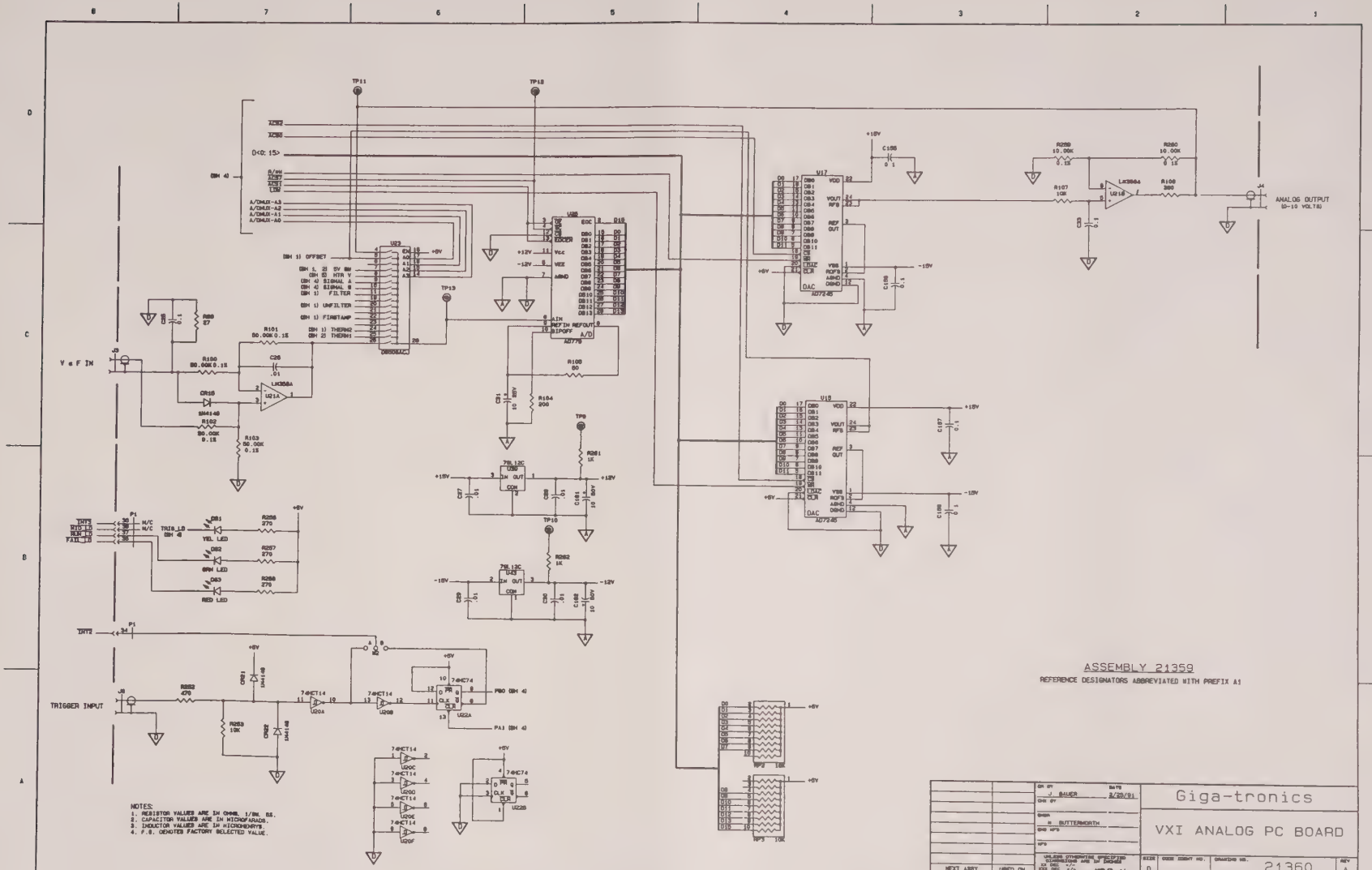
Figure 7-1. Analog PC Board Assembly (A1) #21359

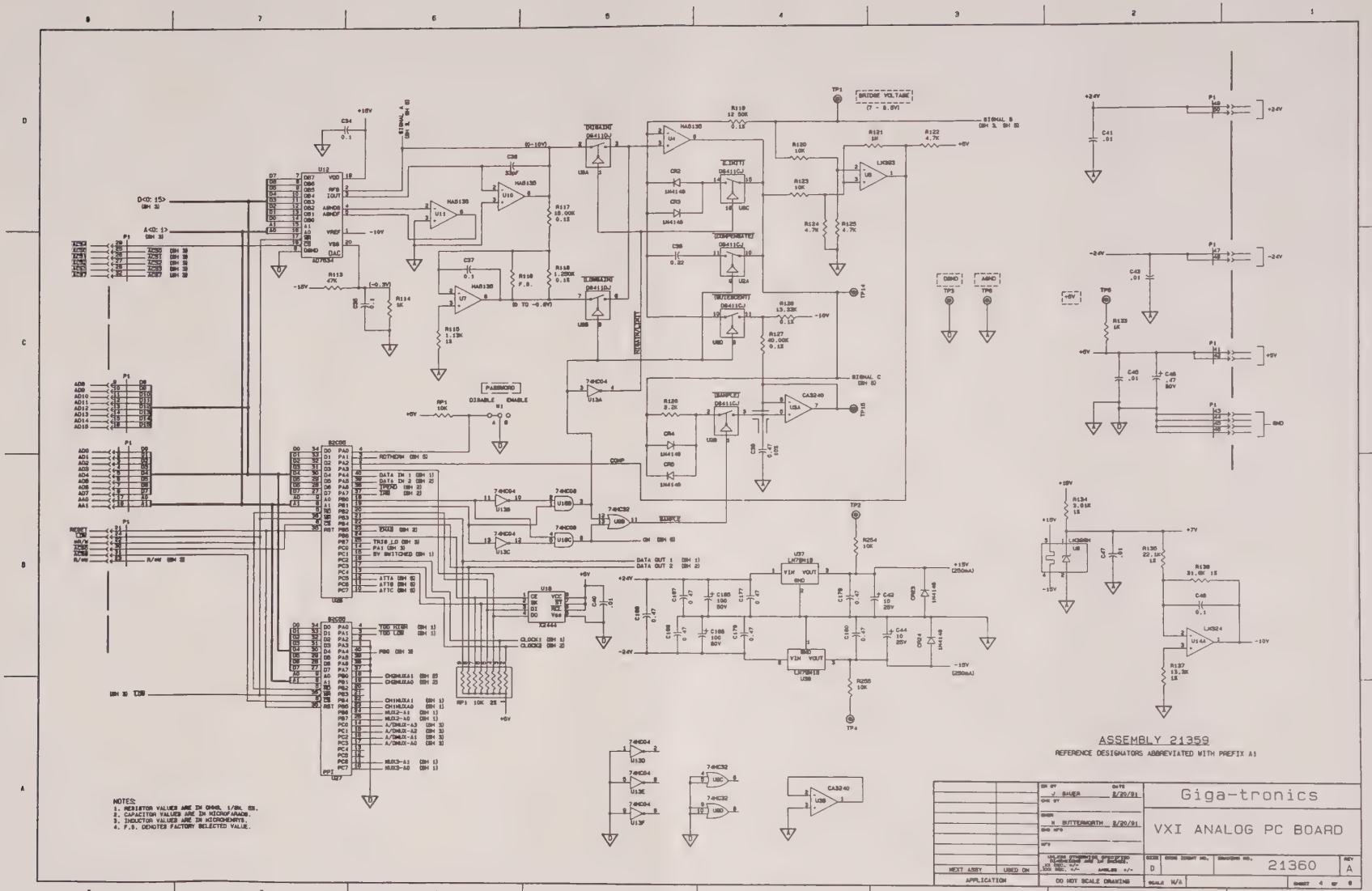
COMPONENT LOCATION TABLE

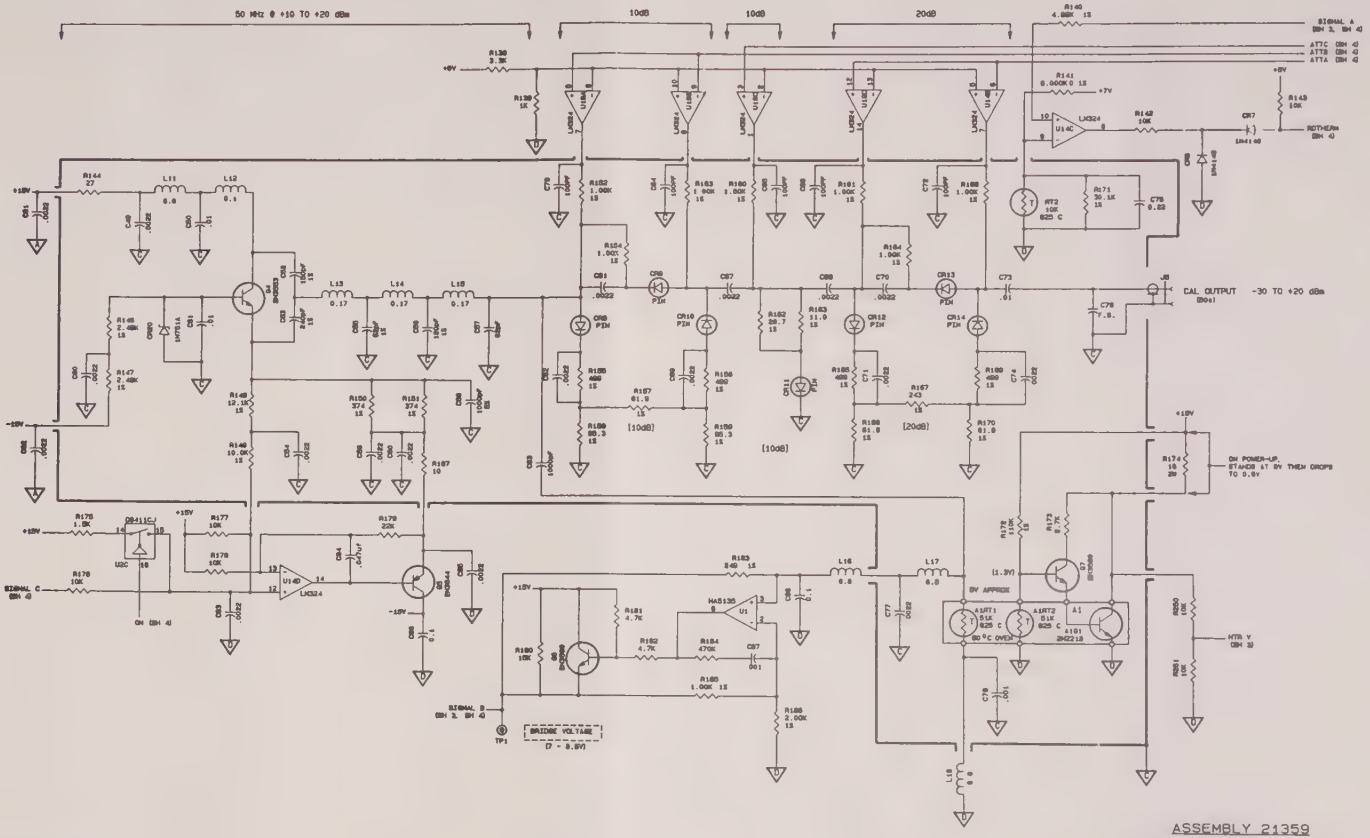
CKT REF	GRID LOC	CKT REF	GRID LOC	CKT REF	GRID LOC	CKT REF	GRID LOC	CKT REF	GRID LOC	CKT REF	GRID LOC	CKT REF	GRID LOC	CKT REF	GRID LOC	CKT REF	GRID LOC
A1	C2	C55	C3	C106	G9	C163	I2	J3	A5	R25	H8	R118	H3	R168	E4	R252	A7/B7	U23	E6
		C56	C2/C3	C107	G8	C167	I8	J4	A5	R26	H8	R119	I1	R169	D4	R253	A6/B6	U24	G25
C10	F10	C57	C3	C108	H8			J5	E5	R27	G8	R120	I1	R170	D4	R256	C5	U25	G6
C11	F10	C58	D3/E3	C109	H9	C171	G7	J6	A6	R28	G8	R121	J2	R171	E4	R257	C5	U26	H6
C12	F9	C59	D2	C110	I8	C173	H7	J7	C7	R29	G8	R122	J2	R172	C2	R258	C5	U27	H7
C13	F10	C60	D2					J8	B7	R30	E6	R123	I1	R173	B2	R259	B5	U28	C7
C14	B6	C61	B4	C112	F10	C174	G7	J9	C8	R31	D6	R124	J2	R174	A2	R260	B5	U29	C8
C15	C6	C62	B4			C175	C6	J10	B8	R32	D6	R125	J2	R175	G1	R261	I9/J9	U30	D8
C17	D6			C114	C7	C176	B6			R33	F6	R126	I2	R176	F2/G2	R262	I9	U31	F8
C18	E6	C63	B3	C115	C8	C177	J4	L11	E2			R127	H2	R177	C1	RP1	I6		
C19	H9	C64	D3	C124	H10	C178	K2	L12	D2	R34	E10	R128	G2/G3	R178	E4	RP2	I7	U32	H8
C20	G9	C65	E3	C126	E6	C179	J4	L13	D3	R35	G6	R131	K8			RP3	G6	U33	H8
C21	H8	C66	E3	C127	E6	C180	K4	L14	C3	R36	J9	R132	J8	R179	E3	RT2	D4/E4	U34	I8
C22	H8	C67	C4	C128	B6			L15	C2	R37	J9			R180	F1	RT3	C6	U35	E10
C23	G9	C68	D4			C185	J3	L16	B1	R38	J8	R133	K8	R181	F1	RT4	B6	U36	G10
C24	G8	C69	D4	C129	B6	C186	J4	L17	B2	R39	I8/I9	R134	E3	R182	F1	RT5	D5	U37	K1
		C70	D4	C130	F3	C187	J3	L18	B2	R40	J8/J9	R135	E4	R183	F2			U38	K3
C25	B5	C71	C4	C131	F3	C188	K4			R41	J8/J9	R136	E4	R184	E2	TP1	G1	U39	H7
C26	B6	C72	E4	C132	F3	C189	J4	P1	I5	R42	J9	R137	F4	R185	F2	TP2	K9	U43	G7
C27	H7	C73	E4	C133	F3	C190	C6			R43	J8	R138	F6	R186	F2	TP3	K10		
C28	H7	C74	D4	C134	G2	C191	C5	Q1	D5			R139	G6	R187	E1	TP4	J9	W1	J9
C29	G7	C75	D3	C135	H2			Q2	D6	R44	I9	R140	E3	R190	D8	TP5	K9	W2	D5
C30	G7	C76	E4	C136	H2	CR1	G10	Q3	D6	R45	J9	R141	E4	R191	D8	TP6	J9		
C31	G7	C77	B3			CR2	I2	Q4	D3	R46	I9	R142	G4			TP7	F5	XQ4	D3
C33	C6			C137	H3	CR3	I2	Q5	E1	R77	E10	R143	H6	R194	E10	TP8	J10		
		C78	B2	C138	G2	CR4	F2	Q6	E1	R78	E10	R144	D2/E2	R195	E10	TP9	J9	XU2	F2
C34	H3	C79	B3/B4	C139	G2	CR5	F2	Q7	C2	R79	G10	R146	E3	R196	H9	TP10	J9	XU3	G2/H2
C35	G3	C80	E2/E3	C140	F4	CR6	G4	Q8	D6	R80	G10			R199	E6	TP11	F5	XU8	H2
C36	F4	C81	E2	C141	F4	CR7	G4			R81	F10	R147	E3	R204	F8	TP12	J10	XU15	G4
C37	G3	C82	E2	C142	G2			R1	D8	R82	G10	R148	D2	R205	F9	TP13	E5	XU17	G4
C38	I2	C83	F2	C143	H2	CR8	B4	R2	D8	R83	G10	R149	D2	R206	G9	TP14	G1	XU23	E6
C39	H1	C84	F4			CR9	C4			R84	H10	R150	D2	R207	G8	TP15	H1		
				C144	F5	CR10	C4	R4	E8	R96	E9	R151	D2	R228	C5	U1	F2	XU28	C7
C40	I4	C85	E1	C145	F4	CR11	C4	R5	E9	R97	H6	R152	B3/B4	R229	C6	U2	F2	XU29	C8
C41	K5	C86	E2	C146	F2	CR12	D4	R6	E8	R98	G5	R153	C3/C4	R232	F3	U3	G2/H2	XU30	D8
C42	J2	C87	F2	C147	F2	CR13	D4/E4	R7	E8	R99	B5	R154	B4			U4	I2	XU31	F8
C43	J5	C88	C1	C148	G5	CR14	D4/E4	R8	E8	R100	B5/B6	R155	B4	R233	F4/G4	U5	I2	XU32	H8
C44	J3	C90	E8	C149	I4			R9	E8	R101	B6	R156	C4	R234	G2/H2	U6	E3/F3	XU33	H8
C45	J5	C91	E9	C150	I2	CR15	B5			R102	B5/B6	R157	C4	R235	H3	U7	G2	XU34	I8
C46	J5	C92	E8	C151	J6	CR16	J8	R10	E9	R103	B6	R158	C4	R240	F4/F5	U8	H2	XU36	G10
C47	F3	C93	J8			CR17	I9	R11	E9	R104	H7	R159	C4	R241	F4/G4	U9	I3		
		C94	J8			CR20	E2	R12	E9	R105	G7	R160	D3/D4	R242	G1/G2	U10	F3	XW1	J9
C48	F4			C152	I3	CR21	D6	R13	F9			R161	D3	R243	H1/H2	U11	F3	XW2	D5
C49	E2	C100	C8	C153	G7	CR22	D6	R14	F8	R107	C6			R246	F2	U12	G3		
C50	D2/D3	C101	C9	C154	J7	CR23	J2	R15	G9	R108	B5	R162	C4	R247	F2	U13	I3		
C51	D3	C102	D8	C155	H4	CR24	J3	R16	H9			R163	C4	R248	H1/H2	U14	F4		
C52	D2/D3	C103	D9	C156	G5			R17	I9	R113	G3	R164	D4	R249	I2	U15	G4		
C53	D3	C104	F8	C157	G4	DS1	A3	R18	I9	R114	G3	R165	D4	R250	E6	U16	I4		
C54	D2	C105	F9	C158	G4	DS2	A2	R19	G9	R115	H3	R166	D4	R251	F6	U17	G4		
						DS3	A2	R20	H9	R116	H1	R167	D5			U18	I4		
				C161	H1			R21	G8	R117	F3					U19	F5		
				C162	J2			R22	H9							U20	C5		
								R23	H9							U21	B6		
								R24	H8							U22	C6		


CHAN B CH+
CHAN B CH-
CHAN B DET GND
CHAN B 8V SWITCHED
CHAN B DET +15V
CHAN B DET -15V
CHAN B THERM RET
CHAN B THERM
CHAN B CLOCK
CHAN B DATA
AD625
LT1014
LM324
74HCT14
OFFSET CBH 31
FIRSTAMP CBH 39
FILTER CBH 32
UNFILTER CBH 39
THERM CHAN2 CBH 21
THERM2 CBH 39
CLOCK2 CBH 41
DATA IN 2 CBH 41
DATA OUT 2 CBH 41
8V SWITCHED
MUX3-A0
MUX3-A1
CBH 40
TOO HIGH CBH 40
TOO LOW CBH 40
6 Pole Bessel Filter
10KHz response
120 microsecond settling time
Amplifier
Gain = 1, 2, 4
NOT LOADED
ASSEMBLY 21359
REFERENCE DESIGNATORS ABBREVIATED WITH PREFIX A1
NOTES:
1. RESISTOR VALUES ARE IN OHMS, 1/8W, 5%.
2. CAPACITOR VALUES ARE IN MICROFARADS.
3. INDUCTOR VALUES ARE IN MICROHENRYS.
4. THE FOLLOWING COMPONENTS ARE NOT LOADED ON THE PC BOARD: R13, R14, AND C167.
5. F.S. DENOTES FACTORY SELECTED VALUE.
Giga-tronics
VXI ANALOG PC BOARD
21360
D
A
J. BAUER
2/25/91
R. BUTTERWORTH
DO NOT SCALE DRAWING


ASSEMBLY 21359
REFERENCE DESIGNATORS ABBREVIATED WITH PREFIX A1
NOTES:
1. RESISTOR VALUES ARE IN OHMS, 1/8W, 5%.
2. CAPACITOR VALUES ARE IN MICROFARADS.
3. INDUCTOR VALUES ARE IN MICROHENRYS.
4. F.S. DENOTES FACTORY SELECTED VALUE.
Giga-tronics
VXI ANALOG PC BOARD
21360
A
APPLICATION
DO NOT SCALE DRAWING
SCALE N/A
SHEET 2 OF 8

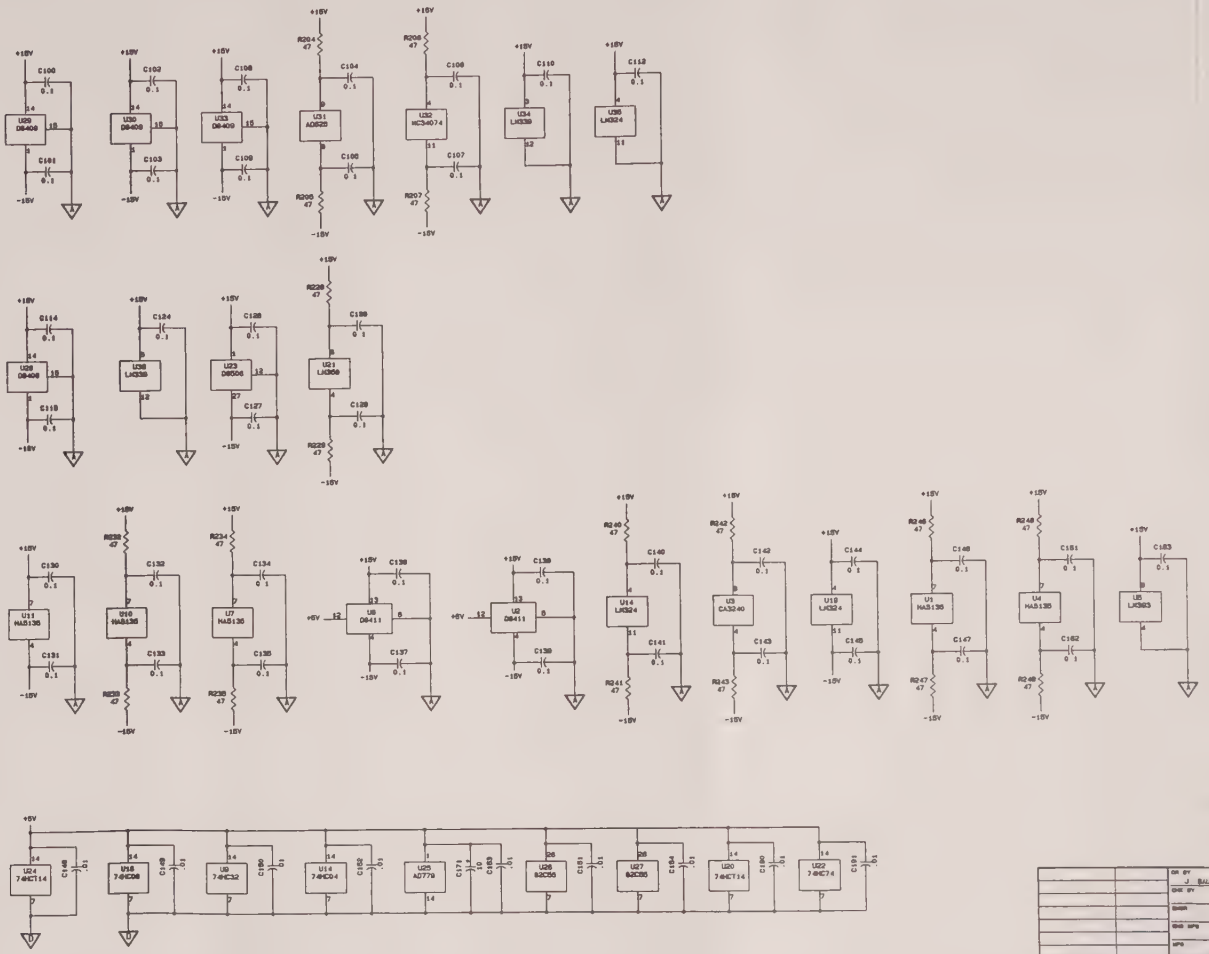

ASSEMBLY 21359
REFERENCE DESIGNATORS ABBREVIATED WITH PREFIX A1
NOTES:
1. RESISTOR VALUES ARE IN OHMS, 1/8W, 5%.
2. CAPACITOR VALUES ARE IN MICROFARADS.
3. INDUCTOR VALUES ARE IN MICROHENRYS.
4. F.S. DENOTES FACTORY SELECTED VALUE.
TRIGGER INPUT
V to F IN
ANALOG OUTPUT (0-10 VOLTS)
Giga-tronics
VXI ANALOG PC BOARD
21360
DO NOT SCALE DRAWING


BRIDGE VOLTAGE
(7 - 8.6V)
SIGNAL B
SIGNAL C
DGND
AGND
ASSEMBLY 21359
REFERENCE DESIGNATORS ABBREVIATED WITH PREFIX A1
NOTES:
1. RESISTOR VALUES ARE IN OHMS, 1/8W, 5%.
2. CAPACITOR VALUES ARE IN MICROFARADS.
3. INDUCTOR VALUES ARE IN MICROHENRYS.
4. F.S. DENOTES FACTORY SELECTED VALUE.
Giga-tronics
VXI ANALOG PC BOARD
21360
DO NOT SCALE DRAWING



NOTES:
1. RESISTOR VALUES ARE IN OHMS, 1/8W, 5%.
2. CAPACITOR VALUES ARE IN MICROFARADS.
3. INDUCTOR VALUES ARE IN NICROHENRYS.
4. F.S. DENOTES FACTORY SELECTED VALUE.

DR BY J. BAUER	DATE 8/20/91	Giga-tronics	
CHK BY NAME	00/00/00	VXI ANALOG PC BOARD	
ENGR N. BUTTERWORTH	8/20/91		
MFG			
NEXT ASSY	USED ON	SIZE D	CAGE IDENT NO. 21360 REV A
APPLICATION	DO NOT SCALE DRAWING	SCALE N/A	SHEET 5 OF 8



NOTES:
1. RESISTOR VALUES ARE IN OHMS, 1/8W, 5%.
2. CAPACITOR VALUES ARE IN MICROFARADS.
3. INDUCTOR VALUES ARE IN MICROHENRYS.
4. P.S. DENOTES FACTORY SELECTED VALUE.

ASSEMBLY 21359

REFERENCE DESIGNATORS ABBREVIATED WITH PREFIX A1

		DR BY J BAUER	DATE 5/8/91	Giga-tronics
		CHK BY		VXI ANALOG PC BOARD
		ENGR		
		ENG MFG		
		MFG		
NEXT ASSY	USED ON	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. .XX DEC. +/- .XXX DEC. +/- ANGLES +/-	SIZE D	DRAWING NO. 21360 REV A
APPLICATION		DO NOT SCALE DRAWING	SCALE N/A	SHEET 8 OF 8

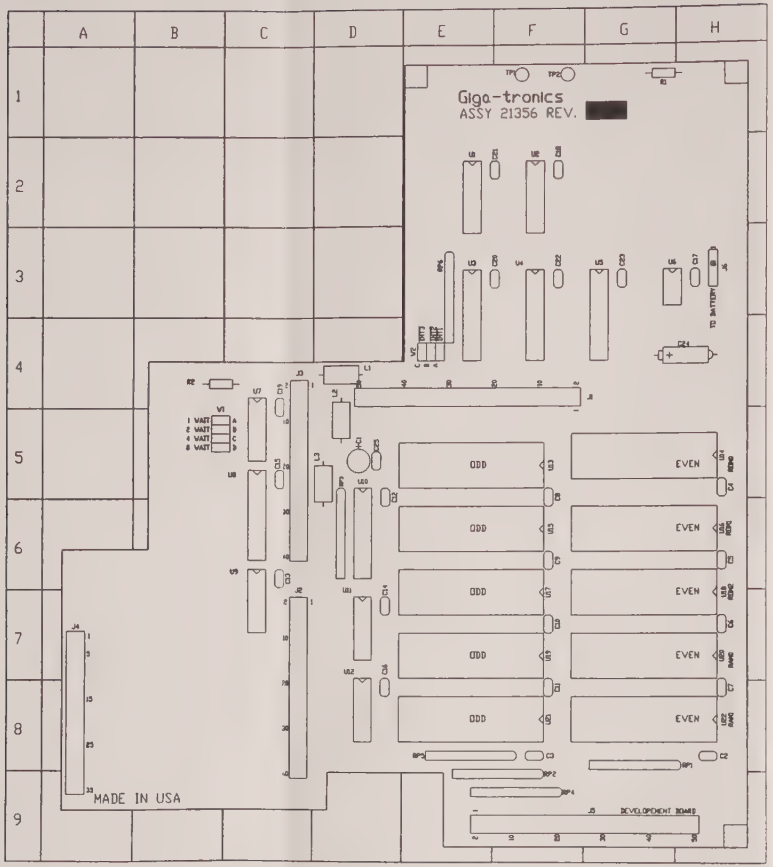
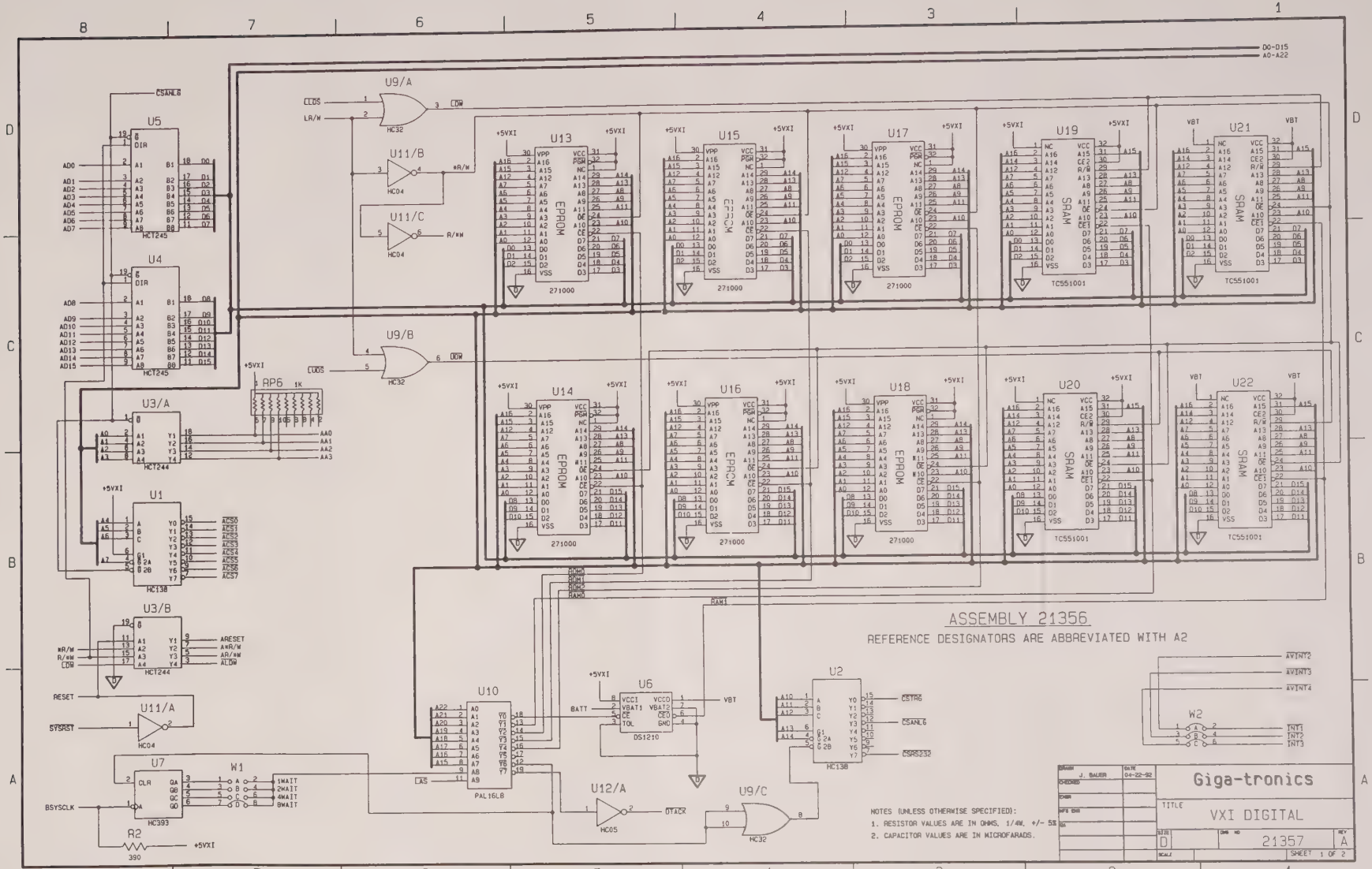
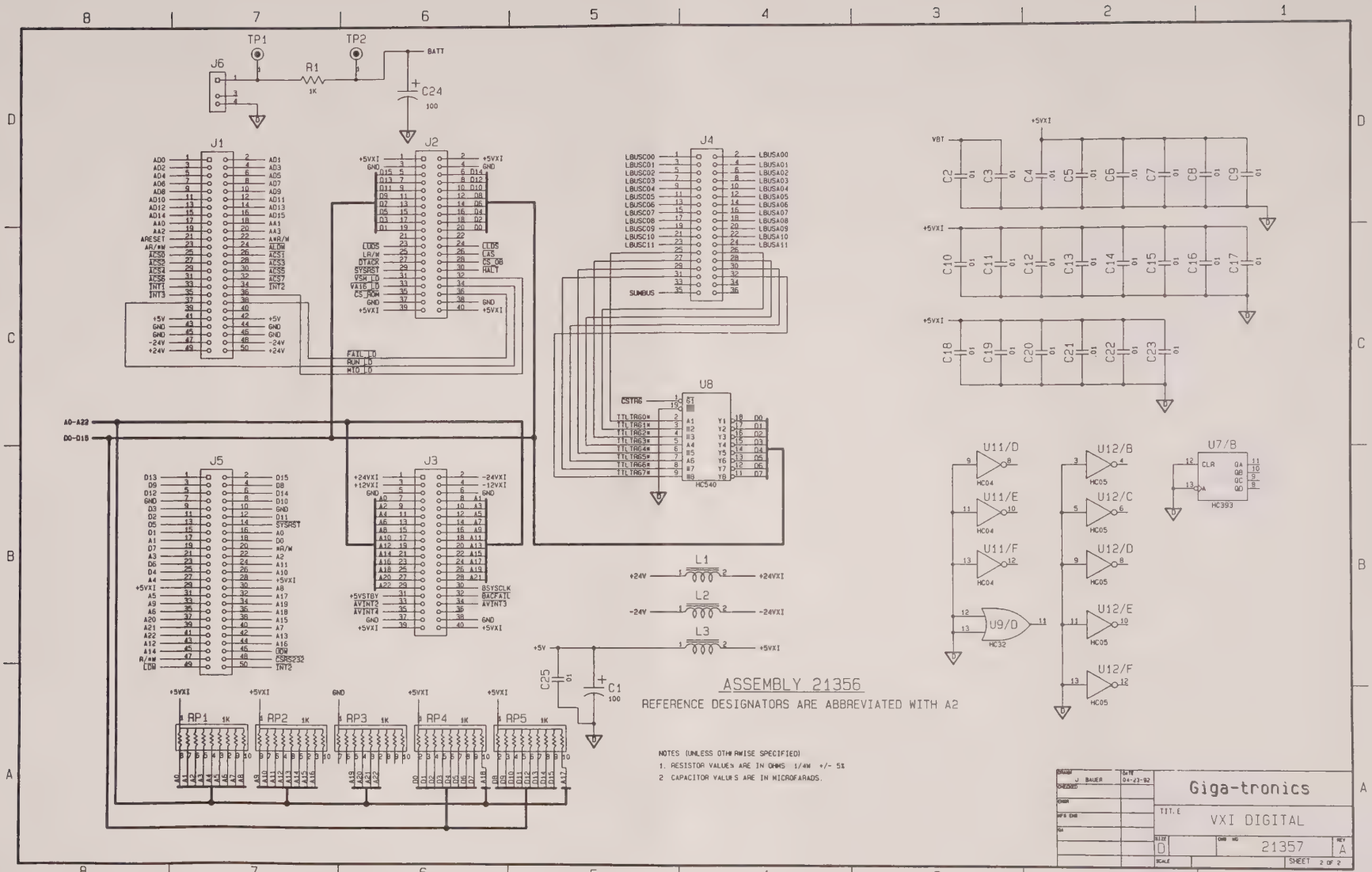


Figure 7-2. Digital PC Board Assembly (A2) #21356

COMPONENT LOCATION TABLE

CKT REF	GRID LOC	CKT REF	GRID LOC	CKT REF	GRID LOC
C1	D5	R1	G1	XU10	D5
C2	H8	R2	B4	XU13	F5
C3	F8			XU14	H5
C4	H5			XU15	F6
C5	H6	RP1	H8	XU16	H6
C6	H7	RP2	F9	XU17	F7
C7	H8	RP3	D5	XU18	H7
C8	F5	RP4	F9		
C9	F6	RP5	E8		
C10	F7	RP6	E3	W1	B5
C11	F8			W2	E4
C12	D5	TP1	F1		
C13	C6	TP2	F1		
C14	D7				
C15	C5				
C16	D8	U1	E2		
C17	H3	U2	F2		
C18	F2	U3	E3		
C19	C4	U4	F3		
C20	E3	U5	G3		
C21	E2	U6	G3		
C22	F3	U7	C4		
C23	G3	U8	C5		
C24	H4	U9	C6		
C25	D5	U10	D5		
		U11	D7		
J1	G4	U12	D8		
J2	C7	U13	F5		
J3	C4	U14	H5		
J4	A7	U15	F6		
J5	G9	U16	H6		
J6	H3	U17	F7		
		U18	H7		
L1	D4	U19	F7		
L2	D4	U20	H7		
L3	D5	U21	F8		
		U22	H8		


ASSEMBLY 21356
REFERENCE DESIGNATORS ARE ABBREVIATED WITH A2
NOTES (UNLESS OTHERWISE SPECIFIED):
1. RESISTOR VALUES ARE IN OHMS, 1/4W, +/- 5%
2. CAPACITOR VALUES ARE IN MICROFARADS.
Giga-tronics
VXI DIGITAL
21357
SHEET 1 OF 2



ASSEMBLY 21356

REFERENCE DESIGNATORS ARE ABBREVIATED WITH A2

NOTES (UNLESS OTHERWISE SPECIFIED)

1. RESISTOR VALUES ARE IN OHMS 1/4W +/- 5%
2. CAPACITOR VALUES ARE IN MICROFARADS.

DRAWN J BAUER	DATE 04-23-92	Giga-tronics	
CHECKED		TITLE VXI DIGITAL	
ENGR		SIZE D	DWG NO 21357 REV A
MFG ENG		SCALE	SHEET 2 OF 2
QA			

CHAPTER 8

REPLACEABLE PARTS LISTINGS

Description **Page No.**

Model 58542 VXI Power Meter Mainframe Assembly #21383 8-2

Analog PC Board Assembly #21359 (Board #A1) 8-3

Digital PC Board Assembly #21356 (Board #A2) 8-11

VXI Processor PC Board Assembly #21418 (Board #A3)
This board is an OEM assembly purchased from another manufacturer. It must be replaced as an assembly - P/N 21418.

MODEL 58542 - VXI POWER METER #21383

Reference Designator	Part Number	Description	Manufacturer	Manuf. Part Number
A1	21359	PCB ASSY,ANALOG VXI	GIGA-TRONICS, INC.	21359
A2	21356	PCB ASSY,DIGITAL	GIGA-TRONICS, INC.	21356
A3	21418	PCB ASSY,VXI PROCESSOR	GIGA-TRONICS, INC.	21418
BT1	21212	BATTERY,LITHIUM,3.6V	TADIRAN	TL-5242/W
W1	21442	CABLE ASSY,CAL	GIGA-TRONICS, INC.	21442
W2	21405	CABLE ASSY,SENSOR INPUT	GIGA-TRONICS, INC.	21405
W3	21405	CABLE ASSY,SENSOR INPUT	GIGA-TRONICS, INC.	21405

ANALOG PC BOARD ASSY #21359

Reference Designator	Part Number	Description	Manufacturer	Manuf. Part Number
A1A1	20112	CALIB THERM OVEN PCB ASSY	GIGA-TRONICS, INC.	20112
A1C10	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C11	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C12	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C13	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C14	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C15	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C17	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C18	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C19	18831	CAP,MICA,1000PF,100V,5%	ARCO	DM15-102J
A1C20	18831	CAP,MICA,1000PF,100V,5%	ARCO	DM15-102J
A1C21	18831	CAP,MICA,1000PF,100V,5%	ARCO	DM15-102J
A1C22	18831	CAP,MICA,1000PF,100V,5%	ARCO	DM15-102J
A1C23	21327-001	CAP,MICA,820pF,1%,300V	CORNEL-DUBILIER	CD15FC821F03
A1C24	21327-001	CAP,MICA,820pF,1%,300V	CORNEL-DUBILIER	CD15FC821F03
A1C25	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C26	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C27	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C28	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C29	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C30	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C31	21393-001	CAP ELCTCT AXIAL 10uF 20% 50V	NICHICON (AMERICA) CORP.	TVX1H100MAA
A1C33	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C34	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C35	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C36	10001-005	CAP CER 33PF 5% 1000VDC	SPRAGUE ELECTRIC CO.	10TCC-Q33
A1C37	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C38	15776-010	CAP, CER .22UF 10% 50V	PHILLIPS/CENTRALAB	CW30C224K
A1C39	20032-001	CAP POLYPRO 0.47MF 160V 5%	WIMA	MKP-4 0.47/160/5
A1C40	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C41	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C42	10787-002	CAP TANTALUM 12MF 20% 20VDC	SPRAGUE ELECTRIC CO.	196D126X9020JA1
A1C43	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C44	10787-002	CAP TANTALUM 12MF 20% 20VDC	SPRAGUE ELECTRIC CO.	196D126X9020JA1
A1C45	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C46	19599-004	CAP ELCTLT RDL 4.7uF 20% 50V	NICHICON (AMERICA) CORP.	UVX1H4R7MAA
A1C47	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C48	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C49	15776-004	CAP,CER .0022 MFD 10% 50V	PHILLIPS/CENTRALAB	CW15C222K
A1C50	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C51	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C52	10909-013	CAP MICA 150PF 1% 500V	ARCO	DM15-151F
A1C53	10909-018	CAP, SLVR MICA 240pF 1% 500V	ARCO	DM15-241F
A1C54	15776-004	CAP,CER .0022 MFD 10% 50V	PHILLIPS/CENTRALAB	CW15C222K
A1C55	10909-011	CAP. SILVER MICA 62 PF	ARCO	CM05FD620F03
A1C56	10909-012	CAP MICA 120PF 1% 500V	ARCO	CM06FD121J03
A1C57	10909-011	CAP. SILVER MICA 62 PF	ARCO	CM05FD620F03
A1C58	10677-018	CAP MICA 1000PF 5% 500V	ARCO	DM15102J100V
A1C59	15776-004	CAP,CER .0022 MFD 10% 50V	PHILLIPS/CENTRALAB	CW15C222K
A1C60	15776-004	CAP,CER .0022 MFD 10% 50V	PHILLIPS/CENTRALAB	CW15C222K
A1C61	15640-012	CAP CER USTBL .0022uF 10% 100V	PHILLIPS/CENTRALAB	CN15C222K
A1C62	15640-012	CAP CER USTBL .0022uF 10% 100V	PHILLIPS/CENTRALAB	CN15C222K
A1C63	10677-018	CAP MICA 1000PF 5% 500V	ARCO	DM15102J100V
A1C64	15640-001	CAP,CER,USTBLE,100PF,10%,100V	SPRAGUE ELECTRIC CO.	1C10C0G101K050B
A1C65	15640-001	CAP,CER,USTBLE,100PF,10%,100V	SPRAGUE ELECTRIC CO.	1C10C0G101K050B

Reference Designator	Part Number	Description	Manufacturer	Manuf. Part Number
A1C66	15640-001	CAP,CER,USTBLE,100PF,10%,100V	SPRAGUE ELECTRIC CO.	1C10CDG101K050B
A1C67	15640-012	CAP CER USTBL .0022uF 10% 100V	PHILLIPS/CENTRALAB	CN15C222K
A1C68	15640-012	CAP CER USTBL .0022uF 10% 100V	PHILLIPS/CENTRALAB	CN15C222K
A1C69	15640-012	CAP CER USTBL .0022uF 10% 100V	PHILLIPS/CENTRALAB	CN15C222K
A1C70	15640-012	CAP CER USTBL .0022uF 10% 100V	PHILLIPS/CENTRALAB	CN15C222K
A1C71	15640-012	CAP CER USTBL .0022uF 10% 100V	PHILLIPS/CENTRALAB	CN15C222K
A1C72	15640-001	CAP,CER,USTBLE,100PF,10%,100V	SPRAGUE ELECTRIC CO.	1C10CDG101K050B
A1C73	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C74	15640-012	CAP CER USTBL .0022uF 10% 100V	PHILLIPS/CENTRALAB	CN15C222K
A1C75	15776-010	CAP, CER .22UF 10% 50V	PHILLIPS/CENTRALAB	CW30C224K
A1C76	XXXXX-XXX	FACTORY SELECTED VALUE	GIGA-TRONICS, INC.	0
A1C77	15776-004	CAP,CER .0022 MFD 10% 50V	PHILLIPS/CENTRALAB	CW15C222K
A1C78	15776-002	CAP,CER,.001MF,10%,50V	PHILLIPS/CENTRALAB	CW15C102K
A1C79	15640-001	CAP,CER,USTBLE,100PF,10%,100V	SPRAGUE ELECTRIC CO.	1C10CDG101K050B
A1C80	15776-004	CAP,CER .0022 MFD 10% 50V	PHILLIPS/CENTRALAB	CW15C222K
A1C81	15776-004	CAP,CER .0022 MFD 10% 50V	PHILLIPS/CENTRALAB	CW15C222K
A1C82	15776-004	CAP,CER .0022 MFD 10% 50V	PHILLIPS/CENTRALAB	CW15C222K
A1C83	15776-004	CAP,CER .0022 MFD 10% 50V	PHILLIPS/CENTRALAB	CW15C222K
A1C84	15776-008	CAP CER .047 MFD 10% 50V	PHILLIPS/CENTRALAB	CW20C473K
A1C85	15776-004	CAP,CER .0022 MFD 10% 50V	PHILLIPS/CENTRALAB	CW15C222K
A1C86	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C87	15776-002	CAP,CER,.001MF,10%,50V	PHILLIPS/CENTRALAB	CW15C102K
A1C88	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C90	15776-002	CAP,CER,.001MF,10%,50V	PHILLIPS/CENTRALAB	CW15C102K
A1C91	15640-001	CAP,CER,USTBLE,100PF,10%,100V	SPRAGUE ELECTRIC CO.	1C10CDG101K050B
A1C92	15640-001	CAP,CER,USTBLE,100PF,10%,100V	SPRAGUE ELECTRIC CO.	1C10CDG101K050B
A1C93	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C94	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C100	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C101	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C102	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C103	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C104	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C105	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C106	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C107	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C108	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C109	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C110	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C112	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C114	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C115	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C124	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C126	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C127	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C128	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C129	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C130	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C131	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C132	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C133	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C134	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C135	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C136	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C137	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C138	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C139	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C140	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C141	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K

Reference Designator	Part Number	Description	Manufacturer	Manuf. Part Number
A1C142	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C143	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C144	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C145	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C146	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C147	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C148	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C149	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C150	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C151	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C152	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C153	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C154	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C155	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C156	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C157	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C158	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C161	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C162	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C163	15776-005	CAP,CER,0.1MF,10%,50V	PHILLIPS/CENTRALAB	CW20C104K
A1C167	10677-003	CAP MICA 2500PF 5% 500WVDC	CORNELL DUBLIER	CD19FD252J03
A1C171	21393-001	CAP ELCTCT AXIAL 10uF 20% 50V	NICHICON (AMERICA) CORP.	TVX1H100MAA
A1C173	21393-001	CAP ELCTCT AXIAL 10uF 20% 50V	NICHICON (AMERICA) CORP.	TVX1H100MAA
A1C174	21393-001	CAP ELCTCT AXIAL 10uF 20% 50V	NICHICON (AMERICA) CORP.	TVX1H100MAA
A1C175	19599-001	CAP ELCTLT RDL 10uF 20% 50V	NICHICON (AMERICA) CORP.	UVX1H100MAA
A1C176	19599-001	CAP ELCTLT RDL 10uF 20% 50V	NICHICON (AMERICA) CORP.	UVX1H100MAA
A1C177	15776-006	CAP,CER,.47MF,10%,50V	PHILLIPS/CENTRALAB	CW40C4T4K
A1C178	15776-006	CAP,CER,.47MF,10%,50V	PHILLIPS/CENTRALAB	CW40C4T4K
A1C179	15776-006	CAP,CER,.47MF,10%,50V	PHILLIPS/CENTRALAB	CW40C4T4K
A1C180	15776-006	CAP,CER,.47MF,10%,50V	PHILLIPS/CENTRALAB	CW40C4T4K
A1C185	19599-011	CAP ELCTLT RDL 100UF 20% 50V	NICHICON (AMERICA) CORP.	UVX1H101MPA
A1C186	19599-011	CAP ELCTLT RDL 100UF 20% 50V	NICHICON (AMERICA) CORP.	UVX1H101MPA
A1C187	15776-006	CAP,CER,.47MF,10%,50V	PHILLIPS/CENTRALAB	CW40C4T4K
A1C188	15776-006	CAP,CER,.47MF,10%,50V	PHILLIPS/CENTRALAB	CW40C4T4K
A1C189	15776-006	CAP,CER,.47MF,10%,50V	PHILLIPS/CENTRALAB	CW40C4T4K
A1C190	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1C191	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A1CR1	10043	DIODE,1N4148/1N914	NATIONAL SEMICONDUCTOR	1N4148
A1CR2	10043	DIODE,1N4148/1N914	NATIONAL SEMICONDUCTOR	1N4148
A1CR3	10043	DIODE,1N4148/1N914	NATIONAL SEMICONDUCTOR	1N4148
A1CR4	10043	DIODE,1N4148/1N914	NATIONAL SEMICONDUCTOR	1N4148
A1CR5	10043	DIODE,1N4148/1N914	NATIONAL SEMICONDUCTOR	1N4148
A1CR6	10043	DIODE,1N4148/1N914	NATIONAL SEMICONDUCTOR	1N4148
A1CR7	10043	DIODE,1N4148/1N914	NATIONAL SEMICONDUCTOR	1N4148
A1CR8	13618	DIODE,uWAVE PIN SW,.3PF,100ns	SDI	PER WMI PRINT
A1CR9	13618	DIODE,uWAVE PIN SW,.3PF,100ns	SDI	PER WMI PRINT
A1CR10	13618	DIODE,uWAVE PIN SW,.3PF,100ns	SDI	PER WMI PRINT
A1CR11	13618	DIODE,uWAVE PIN SW,.3PF,100ns	SDI	PER WMI PRINT
A1CR12	13618	DIODE,uWAVE PIN SW,.3PF,100ns	SDI	PER WMI PRINT
A1CR13	13618	DIODE,uWAVE PIN SW,.3PF,100ns	SDI	PER WMI PRINT
A1CR14	13618	DIODE,uWAVE PIN SW,.3PF,100ns	SDI	PER WMI PRINT
A1CR15	10043	DIODE,1N4148/1N914	NATIONAL SEMICONDUCTOR	1N4148
A1CR16	10043	DIODE,1N4148/1N914	NATIONAL SEMICONDUCTOR	1N4148
A1CR17	10043	DIODE,1N4148/1N914	NATIONAL SEMICONDUCTOR	1N4148
A1CR20	20064	DIODE,ZENER,5.1V,5%	MOTOROLA (SPD)	1N751A
A1CR21	10043	DIODE,1N4148/1N914	NATIONAL SEMICONDUCTOR	1N4148
A1CR22	10043	DIODE,1N4148/1N914	NATIONAL SEMICONDUCTOR	1N4148
A1CR23	10043	DIODE,1N4148/1N914	NATIONAL SEMICONDUCTOR	1N4148

Reference Designator	Part Number	Description	Manufacturer	Manuf. Part Number
A1CR24	10043	DIODE,1N4148/1N914	NATIONAL SEMICONDUCTOR	1N4148
A1DS1	21376-001	LED,YELLOW,RT ANG BLOCK	DIALIGHT	550-0306
A1DS2	21376-003	LED,GREEN,RT ANG BLOCK	DIALIGHT	550-0206
A1DS3	21376-002	LED,RED,RT ANG BLOCK	DIALIGHT	550-0406
A1J3	21164	CONN,BNC,RT ANG,PC MTG	AMP INC.	413524-1
A1J4	21164	CONN,BNC,RT ANG,PC MTG	AMP INC.	413524-1
A1J5	13271	CONN,COUPLING STRAIGHT JACK	M/A-COM OMNI SPECTRA	700209
A1J6	21164	CONN,BNC,RT ANG,PC MTG	AMP INC.	413524-1
A1J7	21055-002	HEADER STR .079 PITCH 7 POS	J.S.T. CORPORATION	B07-DR
A1J8	21055-002	HEADER STR .079 PITCH 7 POS	J.S.T. CORPORATION	B07-DR
A1J9	21055-002	HEADER STR .079 PITCH 7 POS	J.S.T. CORPORATION	B07-DR
A1J10	21055-002	HEADER STR .079 PITCH 7 POS	J.S.T. CORPORATION	B07-DR
A1L11	10631-010	COIL,RF MLD,6.8UH,10%	DELEVAN	1025-40
A1L12	19203	COIL,RF,0.1UH	TOKIN MAGNETICS, INC.	PER WMI PRINT
A1L13	15293	COIL,RF,.17UH	ZAMBRE CO	PER WMI PRINT
A1L14	15293	COIL,RF,.17UH	ZAMBRE CO	PER WMI PRINT
A1L15	15293	COIL,RF,.17UH	ZAMBRE CO	PER WMI PRINT
A1L16	10631-010	COIL,RF MLD,6.8UH,10%	DELEVAN	1025-40
A1L17	10631-010	COIL,RF MLD,6.8UH,10%	DELEVAN	1025-40
A1L18	10631-010	COIL,RF MLD,6.8UH,10%	DELEVAN	1025-40
A1P1	16570	HEADER DOUBLE ROW 50 POS	AMP INC.	2-87227-5
A1Q1	11531	TRANSISTOR 2N2218	FAIRCHILD	2N2218
A1Q1	21287	TRANSISTOR,MJE170,(PNP)	MOTOROLA (SPD)	MJE170
A1Q2	13634	TRANSISTOR,2N3904	FAIRCHILD	2N3904
A1Q3	13634	TRANSISTOR,2N3904	FAIRCHILD	2N3904
A1Q4	20242	TRANSISTOR,2N3553,(NPN)	TEXAS INSTRUMENTS	2N3553
A1Q5	10023	TRANSISTOR,2N3644	NATIONAL SEMICONDUCTOR	3644
A1Q6	10017	TRANSISTOR,2N3569	NATIONAL SEMICONDUCTOR	0
A1Q7	10017	TRANSISTOR,2N3569	NATIONAL SEMICONDUCTOR	0
A1Q8	13634	TRANSISTOR,2N3904	FAIRCHILD	2N3904
A1R1	10015-013	RES MET FILM 100K OHM 1 % 1/8W	CORNING GLASS WORKS	RN55D 100K OHM 1%
A1R2	10015-013	RES MET FILM 100K OHM 1 % 1/8W	CORNING GLASS WORKS	RN55D 100K OHM 1%
A1R4	10015-207	RES,MF,20.0K OHM,1%,1/8W	CORNING GLASS WORKS	20K OHM 1%
A1R5	10015-207	RES,MF,20.0K OHM,1%,1/8W	CORNING GLASS WORKS	20K OHM 1%
A1R6	10015-060	RES,MF,19.6K OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 19.6K OHM 1% 1/8W
A1R7	10015-202	RES,MF 274 OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 274 OHM 1%
A1R8	10015-126	RES,MF,34.0 OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 34.0 OHM 1% 1/8W
A1R9	10015-360	RES,MF,9.76 OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 9.76 OHM 1%
A1R10	10015-126	RES,MF,34.0 OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 34.0 OHM 1% 1/8W
A1R11	10015-202	RES,MF 274 OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 274 OHM 1%
A1R12	10015-060	RES,MF,19.6K OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 19.6K OHM 1% 1/8W
A1R13	XXXXX-XXA	PART NOT INSTALLED	GIGA-TRONICS, INC.	0
A1R14	XXXXX-XXA	PART NOT INSTALLED	GIGA-TRONICS, INC.	0
A1R15	10015-118	RES,MF,28.7K OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 28.7K OHM 1% 1/8W
A1R16	12449-148	RES MF 70.00K OHM 0.1% 1/8W	PRECISION RESISTIVE PRODU	GP1/4 TC50 70.00K 0.1%
A1R17	12449-147	RES MF 8.750K OHM 0.1% 1/8W	PRECISION RESISTIVE PRODU	GP1/4 TC50 8.750K 0.1%
A1R18	12449-032	RES MF 1.250K OHM 0.1% 1/8W	ACI	EE 1/8 C2
A1R19	10015-007	RES,MF,10.0K OHM,1%,1/8W	DALE ELECTRONICS	RN55D 10.0KOHM 1% 1/8W
A1R20	10015-007	RES,MF,10.0K OHM,1%,1/8W	DALE ELECTRONICS	RN55D 10.0KOHM 1% 1/8W
A1R21	10015-007	RES,MF,10.0K OHM,1%,1/8W	DALE ELECTRONICS	RN55D 10.0KOHM 1% 1/8W
A1R22	10015-159	RES,MF,402 OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 402 OHM 1%
A1R23	10015-007	RES,MF,10.0K OHM,1%,1/8W	DALE ELECTRONICS	RN55D 10.0KOHM 1% 1/8W
A1R24	10015-007	RES,MF,10.0K OHM,1%,1/8W	DALE ELECTRONICS	RN55D 10.0KOHM 1% 1/8W
A1R25	10015-289	RES,MF,3.65K OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 3.65K OHM 1%
A1R26	10015-007	RES,MF,10.0K OHM,1%,1/8W	DALE ELECTRONICS	RN55D 10.0KOHM 1% 1/8W
A1R27	10015-007	RES,MF,10.0K OHM,1%,1/8W	DALE ELECTRONICS	RN55D 10.0KOHM 1% 1/8W
A1R28	10015-007	RES,MF,10.0K OHM,1%,1/8W	DALE ELECTRONICS	RN55D 10.0KOHM 1% 1/8W
A1R29	10015-007	RES,MF,10.0K OHM,1%,1/8W	DALE ELECTRONICS	RN55D 10.0KOHM 1% 1/8W

Reference Designator	Part Number	Description	Manufacturer	Manuf. Part Number
A1R30	10013-025	RES DEP CARB 1K OHM 5% 1/4W	MEPCO/ELECTRA	RC072FxxxJ
A1R31	10142-008	RES CARB COMP 47 OHM 5% 1/4W	STACKPOLE	RC07GF470J
A1R32	10013-017	RES DEP CARB 220 OHM 5% 1/4W	MEPCO/ELECTRA	RC072F221J
A1R33	10013-028	RES DEP CARB 1.8K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F182J
A1R34	10013-049	RES DEP CARB 100K OHM 5% 1/4W	MEPCO/ELECTRA	CR25 100K 5%
A1R35	10013-033	RES DEP CARB 4.7K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F472J
A1R36	10015-116	RES,MF,30.1K OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 30.1K OHM 1% 1/8W
A1R37	10015-007	RES,MF,10.0K OHM,1%,1/8W	DALE ELECTRONICS	RN55D 10.0KOHM 1% 1/8W
A1R38	10015-233	RES,MF,174K OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 174K OHM 1%
A1R39	10015-007	RES,MF,10.0K OHM,1%,1/8W	DALE ELECTRONICS	RN55D 10.0KOHM 1% 1/8W
A1R40	10015-207	RES,MF,20.0K OHM,1%,1/8W	CORNING GLASS WORKS	20K OHM 1%
A1R41	10015-007	RES,MF,10.0K OHM,1%,1/8W	DALE ELECTRONICS	RN55D 10.0KOHM 1% 1/8W
A1R42	10015-007	RES,MF,10.0K OHM,1%,1/8W	DALE ELECTRONICS	RN55D 10.0KOHM 1% 1/8W
A1R43	10013-056	RES CARB FILM 390K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F394J
A1R44	10015-007	RES,MF,10.0K OHM,1%,1/8W	DALE ELECTRONICS	RN55D 10.0KOHM 1% 1/8W
A1R45	10015-054	RES,MF,110K OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 110K OHM 1%
A1R46	10015-007	RES,MF,10.0K OHM,1%,1/8W	DALE ELECTRONICS	RN55D 10.0KOHM 1% 1/8W
A1R77	10013-037	RES DEP CARB 10K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F103J
A1R78	10013-037	RES DEP CARB 10K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F103J
A1R79	10015-247	RES,MF,22.1K OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 22.1K OHM 1%
A1R80	10015-007	RES,MF,10.0K OHM,1%,1/8W	DALE ELECTRONICS	RN55D 10.0KOHM 1% 1/8W
A1R81	10013-045	RES DEP CARB 47K OHM 5% 1/4W	MEPCO/ELECTRA	CR25 47K 5%
A1R82	10013-037	RES DEP CARB 10K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F103J
A1R83	10015-007	RES,MF,10.0K OHM,1%,1/8W	DALE ELECTRONICS	RN55D 10.0KOHM 1% 1/8W
A1R84	10015-007	RES,MF,10.0K OHM,1%,1/8W	DALE ELECTRONICS	RN55D 10.0KOHM 1% 1/8W
A1R96	10013-049	RES DEP CARB 100K OHM 5% 1/4W	MEPCO/ELECTRA	CR25 100K 5%
A1R97	10013-028	RES DEP CARB 1.8K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F182J
A1R98	10013-033	RES DEP CARB 4.7K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F472J
A1R99	10013-006	RES DEP CARB 27 OHM 5% 1/4W	MEPCO/ELECTRA	RC072FxxxJ
A1R100	12449-053	RES MF 50.00K OHM 0.1% 1/8W	DALE ELECTRONICS	MMF 1/8 T2
A1R101	12449-053	RES MF 50.00K OHM 0.1% 1/8W	DALE ELECTRONICS	MMF 1/8 T2
A1R102	12449-053	RES MF 50.00K OHM 0.1% 1/8W	DALE ELECTRONICS	MMF 1/8 T2
A1R103	12449-053	RES MF 50.00K OHM 0.1% 1/8W	DALE ELECTRONICS	MMF 1/8 T2
A1R104	10013-089	RES CARB FILM 200 OHM 5% 1/4W	MEPCO/ELECTRA	B803 104NB 201
A1R105	10013-086	RES CARB FILM 51 OHM 5% 1/4W	MEPCO/ELECTRA	B803 104NB 510
A1R107	10013-037	RES DEP CARB 10K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F103J
A1R108	10013-020	RES DEP CARB 390 OHM 5% 1/4W	MEPCO/ELECTRA	CR25-390 OHM 5%
A1R113	10013-045	RES DEP CARB 47K OHM 5% 1/4W	MEPCO/ELECTRA	CR25 47K 5%
A1R114	10013-025	RES DEP CARB 1K OHM 5% 1/4W	MEPCO/ELECTRA	RC072FxxxJ
A1R115	10015-064	RES MET FILM 1.13K OHM 1% 1/8W	CORNING GLASS WORKS	RN55D 1.13K OHM 1%
A1R117	12449-048	RES MF 15.00K OHM 0.1% 1/8W	DALE ELECTRONICS	MFF 1/8 T2
A1R118	12449-032	RES MF 1.250K OHM 0.1% 1/8W	ACI	EE 1/8 C2
A1R119	12449-028	RES MF 12.5K OHM 0.1% 1/8W	ACI	EE 1/8 C2
A1R120	10013-037	RES DEP CARB 10K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F103J
A1R121	10013-061	RES DEP CARB 1M OHM 5% 1/4W	MEPCO/ELECTRA	RC072F105J
A1R122	10013-033	RES DEP CARB 4.7K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F472J
A1R123	10013-037	RES DEP CARB 10K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F103J
A1R124	10013-033	RES DEP CARB 4.7K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F472J
A1R125	10013-033	RES DEP CARB 4.7K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F472J
A1R126	12449-128	RES MF 13.33K OHM 0.1% 1/8W	DALE ELECTRONICS	MFF 1/8 T2
A1R127	12449-129	RES MF 40.00K OHM 0.1% 1/8W	ACI	EE 1/8 C2
A1R128	10015-226	RES,MF,2.21K OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 2.21K OHM 1%
A1R131	10013-078	RES DEP CARB 2K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F202J
A1R132	10013-078	RES DEP CARB 2K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F202J
A1R133	10013-025	RES DEP CARB 1K OHM 5% 1/4W	MEPCO/ELECTRA	RC072FxxxJ
A1R134	10015-110	RES MET FILM 3.01K OHM 1% 1/8W	CORNING GLASS WORKS	RN55D 3.01K OHM 1% 1/8W
A1R135	10015-247	RES,MF,22.1K OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 22.1K OHM 1%
A1R136	10015-014	RES,MF,31.6K OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 31.6K OHM 1%
A1R137	10015-098	RES MET FILM 13.3K OHM 1% 1/8W	CORNING GLASS WORKS	RN55D 13.3K OHM 1% 1/8W

Reference Designator	Part Number	Description	Manufacturer	Manuf. Part Number
A1R138	10013-031	RES DEP CARB 3.3K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F332J
A1R139	10013-025	RES DEP CARB 1K OHM 5% 1/4W	MEPCO/ELECTRA	RC072FxxxJ
A1R140	10015-065	RES MET FILM 4.99K OHM 1% 1/8W	CORNING GLASS WORKS	RN55D 4.99K OHM 1%
A1R141	12449-090	RES MF 8.000K OHM 0.1% 1/8W	PRECISION RESISTIVE PRODU	GP 1/4 TC50
A1R142	10013-037	RES DEP CARB 10K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F103J
A1R143	10013-037	RES DEP CARB 10K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F103J
A1R144	10013-006	RES DEP CARB 27 OHM 5% 1/4W	MEPCO/ELECTRA	RC072FxxxJ
A1R146	10015-047	RES MET FILM 2.49K OHM 1% 1/8W	CORNING GLASS WORKS	RN55D 2.49K OHM 1%
A1R147	10015-047	RES MET FILM 2.49K OHM 1% 1/8W	CORNING GLASS WORKS	RN55D 2.49K OHM 1%
A1R148	10015-096	RES MET FILM 12.1K OHM 1% 1/8W	CORNING GLASS WORKS	RN55D 12.1K OHM 1% 1/8W
A1R149	10015-007	RES,MF,10.0K OHM,1%,1/8W	DALE ELECTRONICS	RN55D 10.0KOHM 1% 1/8W
A1R150	10015-112	RES MET FILM 374 OHM 1% 1/8W	DALE ELECTRONICS	RN55D 374 OHM 1% 1/8W
A1R151	10015-112	RES MET FILM 374 OHM 1% 1/8W	DALE ELECTRONICS	RN55D 374 OHM 1% 1/8W
A1R152	10015-019	RES,MF,1.00K OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 1K OHM 1%
A1R153	10015-019	RES,MF,1.00K OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 1K OHM 1%
A1R154	10015-019	RES,MF,1.00K OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 1K OHM 1%
A1R155	10015-140	RES MET FILM 499 OHM 1% 1/8W	CORNING GLASS WORKS	RN55D 499 OHM 1%
A1R156	10015-140	RES MET FILM 499 OHM 1% 1/8W	CORNING GLASS WORKS	RN55D 499 OHM 1%
A1R157	10015-082	RES,MF,61.9 OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 61.9 OHM 1% 1/8W
A1R158	10015-144	RES MET FILM 95.3 OHM 1% 1/8W	CORNING GLASS WORKS	RN55D 95.3 OHM 1%
A1R159	10015-144	RES MET FILM 95.3 OHM 1% 1/8W	CORNING GLASS WORKS	RN55D 95.3 OHM 1%
A1R160	10015-256	RES MET FILM 1.5K OHM 1% 1/8W	CORNING GLASS WORKS	RN55D 1.5K OHM 1%
A1R161	10015-019	RES,MF,1.00K OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 1K OHM 1%
A1R162	10015-125	RES MET FILM 28.7 OHM 1% 1/8W	CORNING GLASS WORKS	RN55D 28.7 OHM 1% 1/8W
A1R163	10015-122	RES,MF,11.0 OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 11 OHM 1% 1/8W
A1R164	10015-019	RES,MF,1.00K OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 1K OHM 1%
A1R165	10015-140	RES MET FILM 499 OHM 1% 1/8W	CORNING GLASS WORKS	RN55D 499 OHM 1%
A1R166	10015-082	RES,MF,61.9 OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 61.9 OHM 1% 1/8W
A1R167	10015-200	RES MET FILM 243 OHM 1% 1/8W	CORNING GLASS WORKS	RN55D 243 OHM 1%
A1R168	10015-019	RES,MF,1.00K OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 1K OHM 1%
A1R169	10015-140	RES MET FILM 499 OHM 1% 1/8W	CORNING GLASS WORKS	RN55D 499 OHM 1%
A1R170	10015-082	RES,MF,61.9 OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 61.9 OHM 1% 1/8W
A1R171	10015-116	RES,MF,30.1K OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 30.1K OHM 1% 1/8W
A1R172	10015-054	RES,MF,110K OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 110K OHM 1%
A1R173	10013-030	RES DEP CARB 2.7K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F272J
A1R174	11845-004	RES MTL GLAZE 15 OHM 10% 2W	CORNING GLASS WORKS	FP-2
A1R175	10013-027	RES DEP CARB 1.5K OHM 1/4W	MEPCO/ELECTRA	B803 104NB 152
A1R176	10013-037	RES DEP CARB 10K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F103J
A1R177	10013-037	RES DEP CARB 10K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F103J
A1R178	10013-037	RES DEP CARB 10K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F103J
A1R179	10013-041	RES DEP CARB 22K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F223J
A1R180	10013-039	RES DEP CARB 15K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F153J
A1R181	10013-033	RES DEP CARB 4.7K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F472J
A1R182	10013-033	RES DEP CARB 4.7K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F472J
A1R183	10015-046	RES MET FILM 249 OHM 1% 1/8W	CORNING GLASS WORKS	RN55D 249 OHM 1%
A1R184	10013-057	RES DEP CARB 470K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F474J
A1R185	10015-019	RES,MF,1.00K OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 1K OHM 1%
A1R186	10015-074	RES MET FILM 2.0K OHM 1% 1.8W	CORNING GLASS WORKS	RN55D 2.0K OHM 1% 1/8W
A1R187	10013-001	RES DEP CARB 10 OHM 5% 1/4W	MEPCO/ELECTRA	RC072F100J
A1R190	10015-019	RES,MF,1.00K OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 1K OHM 1%
A1R191	10015-019	RES,MF,1.00K OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 1K OHM 1%
A1R194	10013-037	RES DEP CARB 10K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F103J
A1R195	10013-037	RES DEP CARB 10K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F103J
A1R196	10015-051	RES,MF,15.4K OHM,1%,1/8W	CORNING GLASS WORKS	RN55D 15.4K OHM 1%
A1R199	10015-007	RES,MF,10.0K OHM,1%,1/8W	DALE ELECTRONICS	RN55D 10.0KOHM 1% 1/8W
A1R204	10142-008	RES CARB COMP 47 OHM 5% 1/4W	STACKPOLE	RC07GF470J
A1R205	10142-008	RES CARB COMP 47 OHM 5% 1/4W	STACKPOLE	RC07GF470J
A1R206	10142-008	RES CARB COMP 47 OHM 5% 1/4W	STACKPOLE	RC07GF470J

Reference Designator	Part Number	Description	Manufacturer	Manuf. Part Number
A1R207	10142-008	RES CARB COMP 47 OHM 5% 1/4W	STACKPOLE	RC07GF470J
A1R228	10142-008	RES CARB COMP 47 OHM 5% 1/4W	STACKPOLE	RC07GF470J
A1R229	10142-008	RES CARB COMP 47 OHM 5% 1/4W	STACKPOLE	RC07GF470J
A1R232	10142-008	RES CARB COMP 47 OHM 5% 1/4W	STACKPOLE	RC07GF470J
A1R233	10142-008	RES CARB COMP 47 OHM 5% 1/4W	STACKPOLE	RC07GF470J
A1R234	10142-008	RES CARB COMP 47 OHM 5% 1/4W	STACKPOLE	RC07GF470J
A1R235	10142-008	RES CARB COMP 47 OHM 5% 1/4W	STACKPOLE	RC07GF470J
A1R240	10142-008	RES CARB COMP 47 OHM 5% 1/4W	STACKPOLE	RC07GF470J
A1R241	10142-008	RES CARB COMP 47 OHM 5% 1/4W	STACKPOLE	RC07GF470J
A1R242	10142-008	RES CARB COMP 47 OHM 5% 1/4W	STACKPOLE	RC07GF470J
A1R243	10142-008	RES CARB COMP 47 OHM 5% 1/4W	STACKPOLE	RC07GF470J
A1R246	10142-008	RES CARB COMP 47 OHM 5% 1/4W	STACKPOLE	RC07GF470J
A1R247	10142-008	RES CARB COMP 47 OHM 5% 1/4W	STACKPOLE	RC07GF470J
A1R248	10142-008	RES CARB COMP 47 OHM 5% 1/4W	STACKPOLE	RC07GF470J
A1R249	10142-008	RES CARB COMP 47 OHM 5% 1/4W	STACKPOLE	RC07GF470J
A1R250	10013-037	RES DEP CARB 10K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F103J
A1R251	10013-037	RES DEP CARB 10K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F103J
A1R252	10013-021	RES DEP CARB 470 OHM 5% 1/4W	MEPCO/ELECTRA	RC072F471J
A1R253	10013-037	RES DEP CARB 10K OHM 5% 1/4W	MEPCO/ELECTRA	RC072F103J
A1R256	10013-018	RES DEP CARB 270 OHM 5% 1/4W	MEPCO/ELECTRA	RC072F271J
A1R257	10013-018	RES DEP CARB 270 OHM 5% 1/4W	MEPCO/ELECTRA	RC072F271J
A1R258	10013-018	RES DEP CARB 270 OHM 5% 1/4W	MEPCO/ELECTRA	RC072F271J
A1R259	12449-021	RES MF 10.00K OHM 0.1% 1/8W	ACI	EE 1/8 C2
A1R260	12449-021	RES MF 10.00K OHM 0.1% 1/8W	ACI	EE 1/8 C2
A1R261	10013-025	RES DEP CARB 1K OHM 5% 1/4W	MEPCO/ELECTRA	RC072Fxxx J
A1R262	10013-025	RES DEP CARB 1K OHM 5% 1/4W	MEPCO/ELECTRA	RC072Fxxx J
A1RP1	14882-001	RES NETWK 10K OHM 2% 125MW	ALLEN-BRADLEY CO.	110A103
A1RP2	14882-001	RES NETWK 10K OHM 2% 125MW	ALLEN-BRADLEY CO.	110A103
A1RP3	14882-001	RES NETWK 10K OHM 2% 125MW	ALLEN-BRADLEY CO.	110A103
A1RT1	19425-001	THERMISTOR, GLASS BEAD 51K OHM	THERMOMETRICS	BR16PB513N
A1RT2	15208-001	THERMISTOR, PARALLEL 10K OHM	QUALITY THERMISTOR, INC.	PER WMI PRINT
A1RT2	19425-001	THERMISTOR, GLASS BEAD 51K OHM	THERMOMETRICS	BR16PB513N
A1RT3	20607-002	THMS, PTC 0.75 OHM 0.5A(HOLD)	RAYCHEM CORPORATION	RXE050
A1RT4	20607-002	THMS, PTC 0.75 OHM 0.5A(HOLD)	RAYCHEM CORPORATION	RXE050
A1RT5	20607-002	THMS, PTC 0.75 OHM 0.5A(HOLD)	RAYCHEM CORPORATION	RXE050
A1TP1	14320-002	TEST JACK PIN	OVERLAND PRODUCTS	330.100 W/TIN PLATE
A1TP2	14320-002	TEST JACK PIN	OVERLAND PRODUCTS	330.100 W/TIN PLATE
A1TP3	14320-002	TEST JACK PIN	OVERLAND PRODUCTS	330.100 W/TIN PLATE
A1TP4	14320-002	TEST JACK PIN	OVERLAND PRODUCTS	330.100 W/TIN PLATE
A1TP5	14320-002	TEST JACK PIN	OVERLAND PRODUCTS	330.100 W/TIN PLATE
A1TP6	14320-002	TEST JACK PIN	OVERLAND PRODUCTS	330.100 W/TIN PLATE
A1TP7	14320-002	TEST JACK PIN	OVERLAND PRODUCTS	330.100 W/TIN PLATE
A1TP8	14320-002	TEST JACK PIN	OVERLAND PRODUCTS	330.100 W/TIN PLATE
A1TP9	14320-002	TEST JACK PIN	OVERLAND PRODUCTS	330.100 W/TIN PLATE
A1TP10	14320-002	TEST JACK PIN	OVERLAND PRODUCTS	330.100 W/TIN PLATE
A1TP11	14320-002	TEST JACK PIN	OVERLAND PRODUCTS	330.100 W/TIN PLATE
A1TP12	14320-002	TEST JACK PIN	OVERLAND PRODUCTS	330.100 W/TIN PLATE
A1TP13	14320-002	TEST JACK PIN	OVERLAND PRODUCTS	330.100 W/TIN PLATE
A1TP14	14320-002	TEST JACK PIN	OVERLAND PRODUCTS	330.100 W/TIN PLATE
A1TP15	14320-002	TEST JACK PIN	OVERLAND PRODUCTS	330.100 W/TIN PLATE
A1U1	15135	IC,HA7-5135-5	PRECISION MONOLITHICS	OP-07/CP
A1U2	21189	IC SPST CMOS ANALOG SWITHCHES	SILICONIX INCORPORATED	DG411DJ
A1U3	15233	IC,DUAL BIMAS OP AMP	RCA	CA3240E
A1U4	15135	IC,HA7-5135-5	PRECISION MONOLITHICS	OP-07/CP
A1U5	15491	IC,DUAL COMPARATOR,LINEAR	NATIONAL SEMICONDUCTOR	LM393N
A1U6	15093	INTEGRATED CKT LM399H	NATIONAL SEMICONDUCTOR	LM399H
A1U7	15135	IC,HA7-5135-5	PRECISION MONOLITHICS	OP-07/CP
A1U8	21189	IC SPST CMOS ANALOG SWITHCHES	SILICONIX INCORPORATED	DG411DJ

Reference Designator	Part Number	Description	Manufacturer	Manuf. Part Number
A1U9	19566-009	IC QUAD 2-INP OR GATE	NATIONAL SEMICONDUCTOR	74HC32N
A1U10	15135	IC,HA7-5135-5	PRECISION MONOLITHICS	OP-07/CP
A1U11	15135	IC,HA7-5135-5	PRECISION MONOLITHICS	OP-07/CP
A1U12	17035	IC,DIGITAL TTL	ANALOG DEVICES	AD7534JN
A1U13	19566-003	IC,HEX INV	NATIONAL SEMICONDUCTOR	74HC04
A1U14	13471	IC,LM324N	SGS	LM324AN
A1U15	21187	IC,12 BIT DACPORTS	ANALOG DEVICES	AD7245JN
A1U16	19566-004	IC,QUAD 2 INPUT AND GATE	NATIONAL SEMICONDUCTOR	74HC08N
A1U17	21187	IC,12 BIT DACPORTS	ANALOG DEVICES	AD7245JN
A1U18	19586	IC, 256 BIT NONVOL STATIC RAM	XICOR	X2444P
A1U19	13471	IC,LM324N	SGS	LM324AN
A1U20	17048-014	IC,HEX INV SCHMITT TRIG	MOTOROLA (SPD)	MC74HCT14AN
A1U21	17714	IC,LM358AN	TEXAS INSTRUMENTS	LM358AP
A1U22	19566-010	IC-DUAL D FF w PRSET & CLEAR	NATIONAL SEMICONDUCTOR	74HC74N
A1U23	21190	IC CMOS ANALOG MULTIPLEXERS	SILICONIX INCORPORATED	DG506ACJ
A1U24	17048-014	IC,HEX INV SCHMITT TRIG	MOTOROLA (SPD)	MC74HCT14AN
A1U25	21186	IC 14-BIT 100 KSPS	ANALOG DEVICES	AD779JN
A1U26	14641	INTEGRATED CKT 8255	INTEL	P8255A-5
A1U27	14641	INTEGRATED CKT 8255	INTEL	P8255A-5
A1U28	21188	IC CMOS ANALOG MULTIPLEXERS	SILICONIX INCORPORATED	DG409DJ
A1U29	21188	IC CMOS ANALOG MULTIPLEXERS	SILICONIX INCORPORATED	DG409DJ
A1U30	21188	IC CMOS ANALOG MULTIPLEXERS	SILICONIX INCORPORATED	DG409DJ
A1U31	21185	IC,PROG GAIN INSTR AMPL	ANALOG DEVICES	AD625JN
A1U32	19343	IC,QUAD PRECISION OP AMP	LINEAR TECHNOLOGY	LT1014DN
A1U33	21188	IC CMOS ANALOG MULTIPLEXERS	SILICONIX INCORPORATED	DG409DJ
A1U34	15141	IC, VOLT QUAD COMP LM339N	NATIONAL SEMICONDUCTOR	LM339N
A1U35	13471	IC,LM324N	SGS	LM324AN
A1U36	15141	IC, VOLT QUAD COMP LM339N	NATIONAL SEMICONDUCTOR	LM339N
A1U37	18737	VOLTAGE REGULATOR	TEXAS INSTRUMENTS	UA7815C
A1U38	18739	VOLTAGE REGULATOR	TEXAS INSTRUMENTS	UA7915CKC
A1U39	20555	IC +12V OUTPUT VOLT REG	MOTOROLA (SPD)	MC78L12ACP
A1U43	21191	IC 3-TERMINAL NEG REGULATOR	NATIONAL SEMICONDUCTOR	LM79L12ACZ
A1W1	14514-001	POST,MOD 2	AUTOSPLICE	8-25304432
A1W2	14514-001	POST,MOD 2	AUTOSPLICE	8-25304432
A1XQ4	11037	SPACER,NYLON,TO-5	THERMALLOY	7717-22-N
A1XU2	10978-002	IC SKT,16 PIN	AMP INC.	2-641868-1
A1XU3	10978-004	IC SKT,8 PIN	AMP INC.	2-641866-1
A1XU8	10978-002	IC SKT,16 PIN	AMP INC.	2-641868-1
A1XU15	17069-002	IC SKT,24 PIN,LOW PROFILE(DL)	CAMBION	703-1523-01-04-10
A1XU17	17069-002	IC SKT,24 PIN,LOW PROFILE(DL)	CAMBION	703-1523-01-04-10
A1XU23	10978-009	IC SKT,28 PIN	AMP INC.	2-641873-1
A1XU28	10978-002	IC SKT,16 PIN	AMP INC.	2-641868-1
A1XU29	10978-002	IC SKT,16 PIN	AMP INC.	2-641868-1
A1XU30	10978-002	IC SKT,16 PIN	AMP INC.	2-641868-1
A1XU31	10978-002	IC SKT,16 PIN	AMP INC.	2-641868-1
A1XU32	10978-001	IC SKT, 14 PIN	AMP INC.	2-641867-1
A1XU33	10978-002	IC SKT,16 PIN	AMP INC.	2-641868-1
A1XU34	10978-001	IC SKT, 14 PIN	AMP INC.	2-641867-1
A1XU36	10978-001	IC SKT, 14 PIN	AMP INC.	2-641867-1
A1XW2	17240-001	JUMPER,INSULATED,2 POS	MOLEX, INC.	15-38-1024

DIGITAL PC BOARD ASSY #21356

Reference Designator	Part Number	Description	Manufacturer	Manuf. Part Number
A2C1	19598-006	CAP ELCTLT 100UF 20% 25V RDL	NICHICON (AMERICA) CORP.	ULB1E101MAA
A2C2	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A2C3	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A2C4	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A2C5	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A2C6	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A2C7	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A2C8	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A2C9	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A2C10	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A2C11	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A2C12	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A2C13	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A2C14	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A2C15	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A2C16	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A2C17	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A2C18	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A2C19	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A2C20	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A2C21	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A2C22	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A2C23	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A2C24	17483-003	CAP ELECTRO AXIAL 100MF 25V	NICHICON (AMERICA) CORP.	TVX1E101MAA
A2C25	15776-001	CAP,CER,.01MF,10%,50V	PHILLIPS/CENTRALAB	CW15C103K
A2J1	21423-001	CONN,RECP,PC MT,ELEV,50 POS	SAMTEC	ESW-125-37-S-D
A2J2	21168-002	CONN,RECP,PC MT,40 POS	SAMTEC	SSW-120-01-T-D
A2J3	21168-002	CONN,RECP,PC MT,40 POS	SAMTEC	SSW-120-01-T-D
A2J4	21168-001	CONN,RECP,PC MT,36 POS	SAMTEC	SSW-118-01-T-D
A2J5	XXXXX-XXA	PART NOT INSTALLED	GIGA-TRONICS, INC.	0
A2J6	21421-001	CONN HDR RT ANG POST 4 POS	AMP INC.	640453-4
A2L1	21370	CHOKE,WIDE BAND	PHILIPS COMPONENTS	20010-3B
A2L2	21370	CHOKE,WIDE BAND	PHILIPS COMPONENTS	20010-3B
A2L3	21370	CHOKE,WIDE BAND	PHILIPS COMPONENTS	20010-3B
A2R1	10013-025	RES DEP CARB 1K OHM 5% 1/4W	MEPCO/ELECTRA	RC072FxxxJ
A2R2	10013-020	RES DEP CARB 390 OHM 5% 1/4W	MEPCO/ELECTRA	CR25-390 OHM 5%
A2RP1	14882-009	RES SIP 1K OHM X9 2% 1/8W	BOURNS, INC.	4310R-101-102
A2RP2	14882-009	RES SIP 1K OHM X9 2% 1/8W	BOURNS, INC.	4310R-101-102
A2RP3	14882-009	RES SIP 1K OHM X9 2% 1/8W	BOURNS, INC.	4310R-101-102
A2RP4	14882-009	RES SIP 1K OHM X9 2% 1/8W	BOURNS, INC.	4310R-101-102
A2RP5	14882-009	RES SIP 1K OHM X9 2% 1/8W	BOURNS, INC.	4310R-101-102
A2RP6	14882-009	RES SIP 1K OHM X9 2% 1/8W	BOURNS, INC.	4310R-101-102
A2TP1	14320-002	TEST JACK PIN	OVERLAND PRODUCTS	330.100 W/TIN PLATE
A2TP2	14320-002	TEST JACK PIN	OVERLAND PRODUCTS	330.100 W/TIN PLATE
A2U1	19566-014	IC 3 TO 8 LINE DCDR/DMUXR	NATIONAL SEMICONDUCTOR	74HC138N
A2U2	19566-014	IC 3 TO 8 LINE DCDR/DMUXR	NATIONAL SEMICONDUCTOR	74HC138N
A2U3	17048-015	IC,OCT 3-STATE NONIV BUFFER	MOTOROLA (SPD)	MC74HCT244AN
A2U4	17048-006	IC OCT BUS TRANSCEIVER	TEXAS INSTRUMENTS	SN74HCT245N
A2U5	17048-006	IC OCT BUS TRANSCEIVER	TEXAS INSTRUMENTS	SN74HCT245N
A2U6	21162	IC,NONVOL CONT	DALLAS SC	DS1210
A2U7	19566-029	IC, Counter, Dual 4-Bit Binary	NATIONAL SEMICONDUCTOR	74HC393N
A2U8	19566-040	IC OCT BFR/LINE DRVR 3-ST OUT	TEXAS INSTRUMENTS	SN74HC540N
A2U9	19566-009	IC QUAD 2-INP OR GATE	NATIONAL SEMICONDUCTOR	74HC32N
A2U10	21379	PAL,PROG,VXI DIGITAL	GIGA-TRONICS, INC.	21373
A2U11	19566-003	IC,HEX INV	NATIONAL SEMICONDUCTOR	74HC04

Reference Designator	Part Number	Description	Manufacturer	Manuf. Part Number
A2U12	19566-038	IC,HEX INV W/OPEN DRAIN	MOTOROLA (SPD)	MC74HC05N
A2U13	21371	PROM SET, VXI DIGITAL	GIGA-TRONICS, INC.	21371
A2U14	21371	PROM SET, VXI DIGITAL	GIGA-TRONICS, INC.	21371
A2U15	21371	PROM SET, VXI DIGITAL	GIGA-TRONICS, INC.	21371
A2U16	21371	PROM SET, VXI DIGITAL	GIGA-TRONICS, INC.	21371
A2U17	XXXXX-XXA	PART NOT INSTALLED	GIGA-TRONICS, INC.	0
A2U18	XXXXX-XXA	PART NOT INSTALLED	GIGA-TRONICS, INC.	0
A2U19	XXXXX-XXA	PART NOT INSTALLED	GIGA-TRONICS, INC.	0
A2U20	XXXXX-XXA	PART NOT INSTALLED	GIGA-TRONICS, INC.	0
A2U21	21165	IC 1M 8 BIT STATIC RAM	TOSHIBA AMERICA INC.	TC551001PL-10
A2U22	21165	IC 1M 8 BIT STATIC RAM	TOSHIBA AMERICA INC.	TC551001PL-10
A2W1	XXXXX-XXA	PART NOT INSTALLED	GIGA-TRONICS, INC.	0
A2W2	XXXXX-XXA	PART NOT INSTALLED	GIGA-TRONICS, INC.	0
A2XU10	10978-006	IC SKT,20 PIN	AMP INC.	2-641870-1
A2XU13	10978-012	IC SOCKET, 32 PIN	AMP INC.	2-644018-2
A2XU14	10978-012	IC SOCKET, 32 PIN	AMP INC.	2-644018-2
A2XU15	10978-012	IC SOCKET, 32 PIN	AMP INC.	2-644018-2
A2XU16	10978-012	IC SOCKET, 32 PIN	AMP INC.	2-644018-2
A2XU17	10978-012	IC SOCKET, 32 PIN	AMP INC.	2-644018-2
A2XU18	10978-012	IC SOCKET, 32 PIN	AMP INC.	2-644018-2

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Domestic Representatives (listed alphabetically by rep name)

Creative Marketing Associates
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Fax: (214) 490-0836

Houston, TX.
Phone: (713) 579-2995
Fax: (713) 579-2998

Austin, TX.
Phone: (512) 338-4701
Fax: (512) 338-0873

San Antonio, TX.
Phone: (210) 342-3031
Fax: (210) 525-8680

Metairie, LA.
Phone: (504) 833-3655
Fax: (504) 833-0218

Dytec/South Inc.
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Fax: (314) 739-1405

Lenexa, KS.
Phone: (913) 888-0215
Fax: (913) 894-1039

Wichita, KS.
Phone: (316) 263-7090
Fax: (316) 263-3189

Eastern Instrument. of PA
Southampton, PA.
Phone: (215) 355-7700
Fax: (215) 355-3469

Jack Howard Associates
San Antonio, TX.
Phone: (210) 828-5741
Fax: (210) 828-3207

Micro Concepts
Mclean, VA.
Phone: (703) 893-8108
Fax: (703) 893-7267

Northern Technical Sales
Liverpool, NY.
Phone: (315) 451-1091
Fax: (315) 451-6980

Northwest Test & Measurement
Bellevue, WA.
Phone: (206) 881-8857
Fax: (206) 867-0742

Beaverton, OR.
Phone: (503) 645-9000
Fax: (503) 645-5186
(also Alaska & Hawaii)

RG Associates
Wayzata, MN.
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Fax: (612) 471-8765

Scientific Devices - East
Ridgefield Park, NJ.
Phone: (201) 440-3430
Fax: (201) 440-4474

Southern Marketing Associates
Longwood, FL.
Phone: (407) 682-7317
Fax: (407) 682-7443

Satellite Beach, FL.
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Fax: (407) 777-6705

Huntsville, AL.
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Fax: (205) 534-6059

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Fax: (404) 664-9795

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Fax: (919) 632-7372

Test-Rep Associates, Inc.
Littleton, MA.
Phone: (617) 937-6713
Fax: (508) 534-0486

Torkelson Associates
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Fax: (612) 835-5470

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Arlington Heights, IL.
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Fax: (708) 670-0828

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Fax: (414) 784-7969

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Phone: (303) 781-8819
Fax: (303) 781-8846

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Fax: (505) 293-5632

Ward/Davis Associates
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Fax: (408) 738-3995

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Fax: (310) 643-6035

Ward/Davis Associates (cont.)
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WKM Associates, Inc.
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Fax: (513) 434-6590

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Fax: (216) 524-0276

Troy, MI.
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Fax: (313) 588-9332

Wexford, PA.
Phone: (412) 934-2790
Fax: (412) 934-2761

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Fax: 54-1-11-1427

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Scientific Devices Australia
(Victoria)
Phone: 61-3-802-6956
Fax: 61-3-579-0971
(Salisbury)
Phone: 61-8-281-3788
Fax: 61-8-281-4194
(Maroubra, N.S.W.)
Phone: 61-2-344-5200
Fax: 61-2-349-2602

Belgium
Air Parts Electronics
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Fax: 32-2-241-8130

Canada
Interfax Systems
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Fax: (514) 336-9607
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Phone: (613) 726-8888
Fax: (613) 820-3213
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Fax: (416) 674-8986
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Phone: (604) 582-2151
Fax: (604) 582-2161

Chile
Avantec Technologia de Avanzada Ltd
Phone: 56-2-633-8822
Fax: 56-2-632-5444

China
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Phone: 861-832-5904
Fax: 861-832-5903
(Hong Kong)
Phone: 852-793-0330
Fax: 852-793-0606
(Shanghai)
Phone: 862-1-433-0001
Fax: 862-1-431-9532

Denmark
Crimp A/S
Phone: 45-4810-0500
Fax: 45-4810-0555

England
Sematron (UK) Ltd.
Phone: 44-734-819970
Fax: 44-734-819786

France
Elexience
Phone: 33-1-60-119471
Fax: 33-1-60-119809

Finland
Profelec OY
Phone: 3580-566-4477
Fax: 3580-566-2998

Germany
PC Electronic GMBH
Phone: 49-6047-6949
Fax: 49-6047-6408

Greece
American Technical Enterprises
Phone: 301-524-0620
Fax: 301-524-9995

Holland
Air Parts Int'l B.V.
Phone: 31-1720-43221
Fax: 31-1720-20651

India
Technical Trade Links
(Bombay)
Phone: 91-22-832-2412
Fax: 91-22-837-6719
(New Delhi)
Phone: 91-11-573-6074
Fax: 91-11-575-5812
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Phone: 91-33-753-877
Fax: 91-33-749-632
(Bangalore)
Phone: 80-582-977
Fax: 80-580-795

Israel
Dan-El Technologies Ltd.
Phone: 972-3-544-1466
Fax: 972-3-544-1468

Italy
L. P. Instruments
(Milan)
Phone: 39-2-4840-1713
Fax: 39-2-4840-1852

Sematron Europe S.R.L.
(Rome)
Phone: 011-39-6-8689-5015
Fax: 011-39-6-8680-2253

Japan
Midoriya Electric Co. Ltd.
(Tokyo)
Phone: 81-3-3-561-5763
Fax: 81-3-3-561-5794
(Osaka)
Phone: 81-6-262-0934
Fax: 81-6-261-5909

Korea
Sama Electronics Corp.
Phone: 82-2-271-2761
Fax: 82-2-271-2764

Lebanon
Mabek
Phone: 961-1-864479
Fax: None

New Zealand
Racal New Zealand Ltd.
Phone: 64-4-473-0313
Fax: 64-4-499-1540

Norway
Morgenstierne AS
Phone: 47-22-289490
Fax: 47-22-289-494

Peru
BMP Ingenieros S.A.
Phone: 51-14-335344
Fax: 51-14-335164

Saudi Arabia Kingdom
A. Rajab & Silsilah & Co.
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Fax: 966-2-6610558

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Mecomb Singapore Ltd.
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Fax: 65-467-1905

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Fax: 27-11-786-3789

Spain
Rema
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Fax: 34-1-766-27-73

Sultanate of Oman
Mustafa & Jawad Trading Co. L.L.C.
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Fax: 968-564005

Sweden
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Fax: 46 -8-580-17990

Switzerland
Isatel Electronics AG
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Fax: 41-4241-8043

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Fax: 886-2-712-2466

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Elektro
Phone: 337-22-45-3488-6751
Fax: 337-22-45-336-8814

Venezuela
Equilab C.A.
Phone: 582-239-3233
Fax: 582-239-5205

Equilab - Maracaibo
Phone: 582-61-524-578
Fax: 582-61-527-490

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Signal Generation Division
Pleasant Hill, CA. 94523
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Fax: (415) 680-7736

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